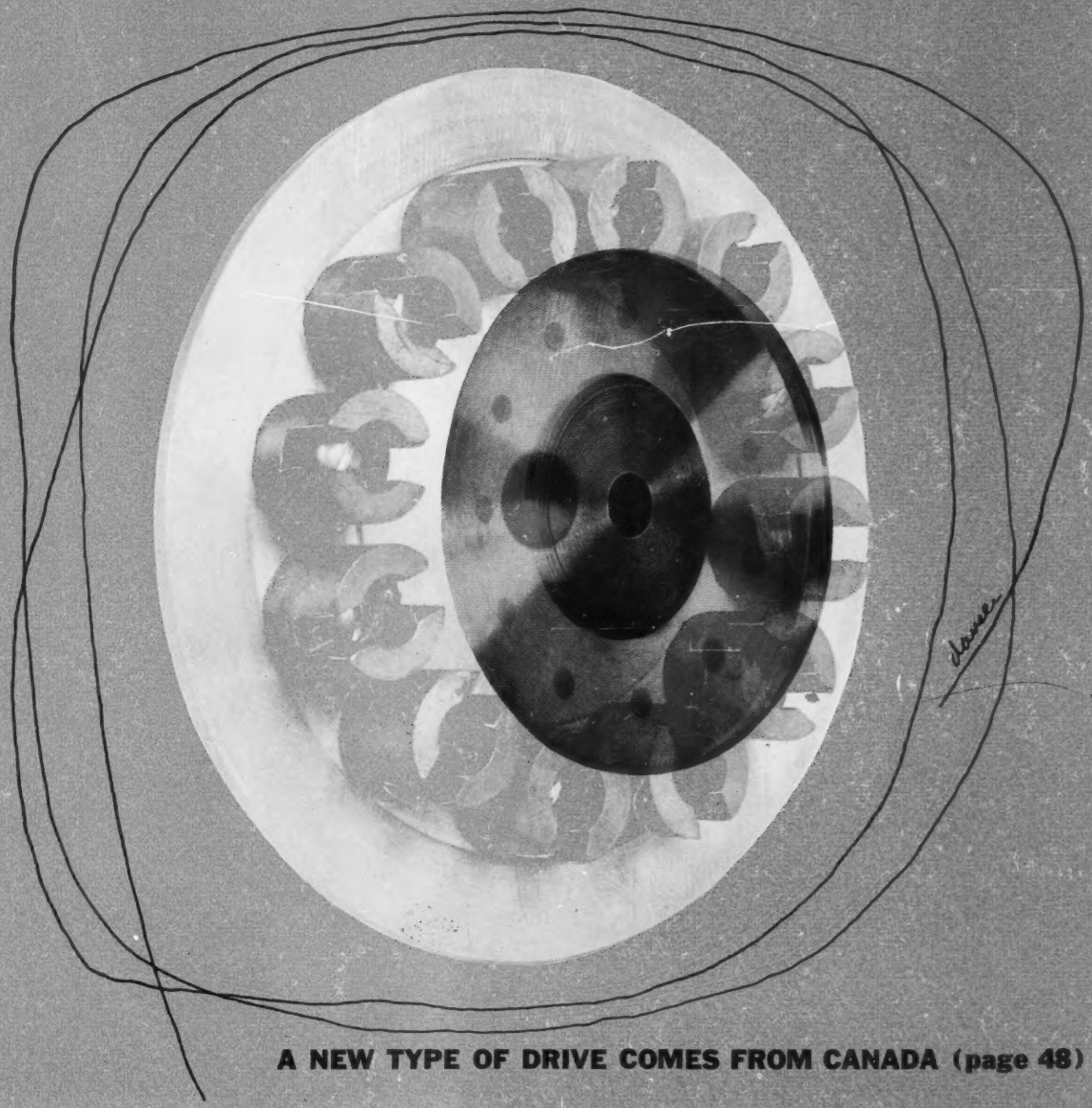
Design Engineering



A NEW TYPE OF DRIVE COMES FROM CANADA (page 48)

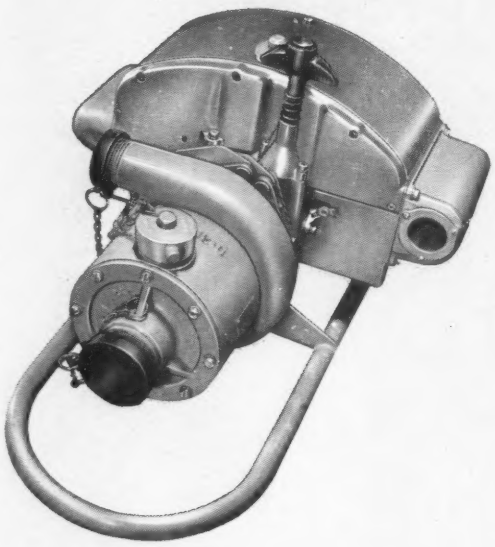
June 1956

Use inserts to make soft threads strong

Avoid mistakes with Vee-belt drives

PUBLISHED BY MACLEAN-HUNTER PUBLISHING COMPANY, LIMITED, TORONTO, CANADA

FOR EASE OF MACHINING...
CLOSE DIMENSIONAL TOLERANCES...
X-RAY CONTROL...
Aluminum Castings from Alcan



The new Watson Jack portable fire-fighting pump, manufactured by B. J. Coghlin Company Limited, Montreal . . . weighs only 55 pounds . . . pumps water at a rate of 85 gallons per minute under pressures of up to 300 pounds per square inch.

Three main sand cast aluminum components of the new pump: body, impeller and distributor — made in Alcan's Etobicoke foundry. The thin walls in the body casting can withstand hydrostatic test of 600 psi without leakage.

Lightness, durability, ease of machining, and no rusting: such a matchless combination of qualities make Aluminum Castings the practical selection for a wide variety of modern products. This high-quality portable pump is just one of many recent interesting examples. Here, aluminum offered the extra advantage of making possible the required impeller RPM with a smaller motor than would have been needed if heavier metal had been used.

We will gladly assist in designing your aluminum castings and are prepared to produce to your desired standards.

ALCAN

ALUMINUM COMPANY OF CANADA, LTD.

Calgary • Halifax • Hamilton • Montreal • Ottawa • Quebec • Toronto • Vancouver • Windsor • Winnipeg

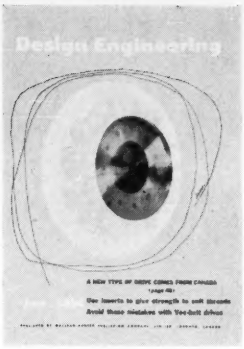
CORING ACHIEVEMENT

"Smoother than sand cast" finish was required in all the complex water passageways. Alcan research — combined with the skills and experience of Alcan craftsmen at the Etobicoke foundry — achieved an extremely smooth cored surface*.

At the same time, unusually close dimensional tolerances were met. Some walls formed by complex core assemblies are machined on one side only to a final thickness of $\frac{1}{32}$ inch.

Metallurgically sound castings were assured by x-ray control. Since internal passages could not be visually inspected, sectioning of representative castings was done to make certain of adequate smoothness, and x-ray and fluoroscope assured there were no blockages.

*125 RMS.



Design Engineering

VOL. 2 JUNE 1956 NO. 6

This month's cover

Don Dancer's cover for this issue shows a typical permanent magnet, eddy current drive of the kind developed by Tormag which is featured this month. He has shown the two basic components. On the right, the bimetallic rotor made of a copper faced, mild steel plate perforated with mild steel rivets as inserts. Ghost-like behind this is the magnetic rotor carrying Alnico V permanent magnets. In practise, the rotors are mounted face to face with an air gap between them. But an artist has to have some freedom somewhere.

Design Engineering

MEMBER

CCAB

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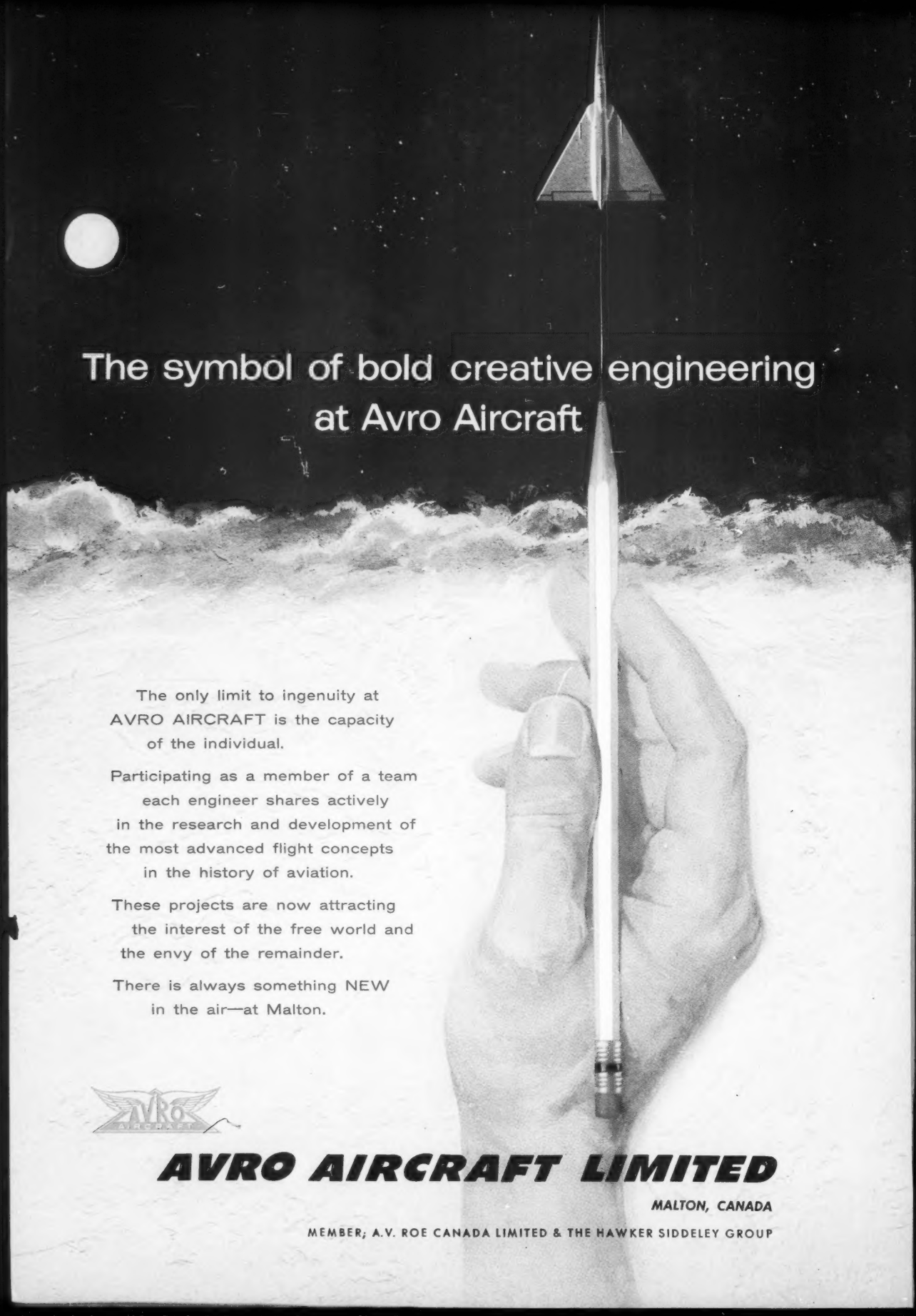

The symbol of bold creative engineering at Avro Aircraft

The only limit to ingenuity at AVRO AIRCRAFT is the capacity of the individual.

Participating as a member of a team each engineer shares actively in the research and development of the most advanced flight concepts in the history of aviation.

These projects are now attracting the interest of the free world and the envy of the remainder.

There is always something NEW in the air—at Malton.

AVRO AIRCRAFT LIMITED

MALTON, CANADA

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Design Engineering

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The **July** issue of **Design Engineering** will carry strong feature articles written by contributors no less experienced than those featured this month.

Watch for the article on fuel injection. This is a trend—fuel injection has many advantages and will become a more important subject as time goes on. All the latest facts will be put before you next month.

Another up-to-the-minute article will discuss miniature ball bearings. They operate at high speed (above 15,000 rpm) and with light lubricants. They have many uses—motors, gear trains, recording instruments are examples.

Kingsmill

When he was asked for a picture of himself, **Peter Kingsmill** reported that the only one he had was taken in a bathing suit 10 years ago. "It would have been different," he said, when explaining why it was not to be offered. He is an electrical engineering graduate of Toronto University, now sales manager for Peckover's Ltd. He gives what he calls "engineering back-up" on the company's beryllium copper (which he writes about on page 40) and nylon products. Spare time interests? "When I am not at home beating my three-year-old-daughter at chess, I spend my time racing sailboats at the Royal Canadian Yacht Club or skiing at the Osler Bluff Ski Club."

Wolfe

The article on wire thread inserts (page 35) is written by **Paul Wolfe** of the Heli-Coil Corporation. He can claim, among other things, to be a professional author with a textbook to his credit. It goes under the stiffish title of "Aircraft Manufacturing Processes" and is a well-accepted authority in the U. S. He is a Baltimore City College graduate in mechanical engineering, has taught his subject at Pennsylvania State College and Baltimore Polytechnic. He is currently a consulting engineer on all manner of threaded fastener problems—including aero engines and air frames. He lives in Bethel, Connecticut, with his wife and two sons — one of whom hopes very soon to enter the U. S. Airforce Academy.

Neuman

Like Peter Kingsmill (above), **F. L. Neuman** is a sailing enthusiast. To this he adds three other hobbies—golf, photography and gardening. He is general manager, New Products Department of Linde Air Products Limited. As a graduate of Michigan College of Mining and Technology in metallurgical engineering, he is well qualified to write about flame plating for hard wearing parts (page 44). Somehow despite the time it takes to be a company executive, to develop hobbies and to write technical articles, he finds time for active membership in various organizations. Two examples: The Association of Professional Engineers of Ontario and the Toronto Board of Trade.

Reports

New in brief from the world's producers

RENFREW, ONTARIO—A new era is unfolding now in Renfrew. On May 11, Dr. J. J. McCann, Minister of National Revenue, pressed a button to open a huge new electronics plant built here by RCA VICTOR CO. LIMITED.

As he did so, the picture of a flag (unfurled electronically above the trim, one-story building) appeared on a television screen before about 90 guests assembled in the plant lunchroom.

The TV screen was part of a closed circuit installed especially for the event. Joined by coaxial cable to a camera on the roof, it showed dramatically one of the newest developments in the fast-growing industry which has come now to this Ottawa Valley centre.

The new plant, third to be built by RCA Victor in the last three years, will eventually provide jobs for some 450 people, giving a major lift to an area hard hit by closing of local textile mills. It was in full production on opening day.

F. R. Deakins, president of RCA Victor, introduced Dr. McCann at the opening ceremony, held early in the evening following a buffet supper. He said that his firm, the largest electronics company in Canada, was proud to become Renfrew's newest citizen.

Other speakers included J. A. Maloney, MPP, D. W. Stewart Jr., Mayor of Renfrew, and L. J. Fraser, Chairman of the Industrial Commission which successfully wooed RCA Victor to the town.

The plant stands on a 30-acre site and measures 332 ft. by 150 ft. It cost about $500,000, and its 53,000-odd sq. ft. of floor space provide room for production of a broad range of electronic products.

All types of clock radios, automobile sets, mantel and table-type receivers will be manufactured and distributed to centres across Canada. Some will be shipped abroad.

Components being produced include deflection yokes and RF tuners for TV sets, and RF coils and transformers for both TV and radio. In addition, Renfrew has become the centre for production of RCA Victor's printed circuits.

The printed circuit is one of the most important of recent developments in the electronics industry. It replaces a maze of wires with a circuit etched on plastic, making production of radios and TV sets faster and less costly, and improving the tone of small radios by making room for bigger tone chambers and speaker magnets.

First sod for the new plant was turned last July, and at that time F. R. Deakins outlined the things about Renfrew that attracted RCA Victor. They included, he said, good living conditions, good educational and health facilities, adequate housing, railways, low cost power, good main highways, and proximity to the company's assembly plant in Prescott.

• • •

CPA raises Britannias order

MONTREAL—It is reported that CANADIAN PACIFIC AIRLINES are increasing their order for Bristol Britannias to five air-aircraft—delivery to begin in 1957. The airline's option of five more Britannias remains unchanged.

CPA began by ordering three last October, then in April increased this to four—and now it goes up to five.

The CPA Britannias are series 310 aircraft, which have a body longer than that of the initial production version (series 100) now being delivered to BOAC, are fitted with Proteus 755 engines of 4120 ehp, and incorporate increased fuel tankage in the wings giving maximum range of 6,220 miles.

When the CPA order was signed last October, it was announced that the Britannia would fly initially on CPA's long-haul Pacific and Polar routes, operating services from Vancouver to Amsterdam, Tokyo to Vancouver, and Honolulu to Vancouver.

The increased order can be regarded as a re-assertion of the faith in the Britannia expressed by Grant McConachie (CPA President) when the contract was first signed. Mr. McConachie then said:

"When the Britannia comes into operation, it will be superior in performance to any other airliner in service on the air routes of the world at that time. The Britannia, the most modern aircraft in flight today, is particularly suited for use on CPA routes because of its long range characteristics. The smooth, quiet operation of the turboprop engine will set a new standard of passenger comfort with the introduction of these advanced aircraft."

Britannias on order to the airlines of the world now total 51.

• • •

Big prize to a GM ideas man

LONDON, ONTARIO—The second highest Suggestion Plan award earned at GENERAL MOTORS DIESEL LTD. was presented recently to Ted Charlton, a production stockkeeper. His idea earned a material saving award of $1,100 for a suggestion submitted under the GM Suggestion Plan.

Mr. Charlton's idea resulted in savings by the company through the use of surplus stock. The jackpot was his fifth award out of 11 suggestions.

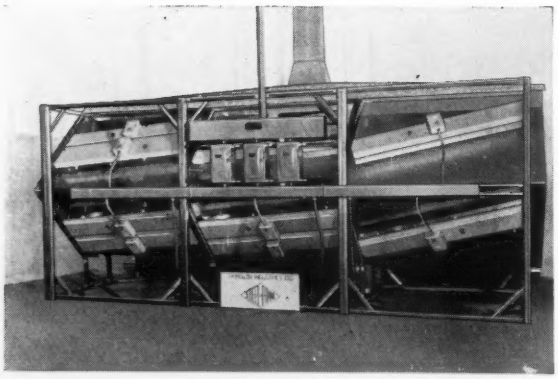
The winner started at General Motors in July, 1950. At a plant luncheon where he and other Suggestion Plan winners received their cheques, President and General Manager, E. V. Rippingille, Jr., lauded employees for their contributions toward the high quality of GM locomotives. He stated that the man on the job is often able to improve his job and the operation of his department through thinking. By putting his thoughts on paper and submitting them as suggestions, he is able to earn money with his good ideas. In addition he gains the feeling of satisfaction and pride at seeing his thoughts in action. "Although not all suggestions can earn awards amounting to $1,100," said President Rippingille, "the scope and opportunity is present. The main thing is not to get discouraged. That next idea may be the big one!"

Since the starting of the plan a total of 1,396 awards have been made at General Motors Diesel. Total earnings by employees for these awards amounts to $29,104.44.

Three, then four, now five Britannias for CPA

"We cut drying time 80% reduced rejects and man-hours with G-E Infra-Red Radiant Calrod Ovens"

"Our G-E Calrod Oven is fast, reliable and saves us money in every stage of our enameling operation," says Ludek Kraszewski, production and methods engineer with Taymouth Industries, Ltd., Toronto, makers of well-known refrigerators and other steel products . . .



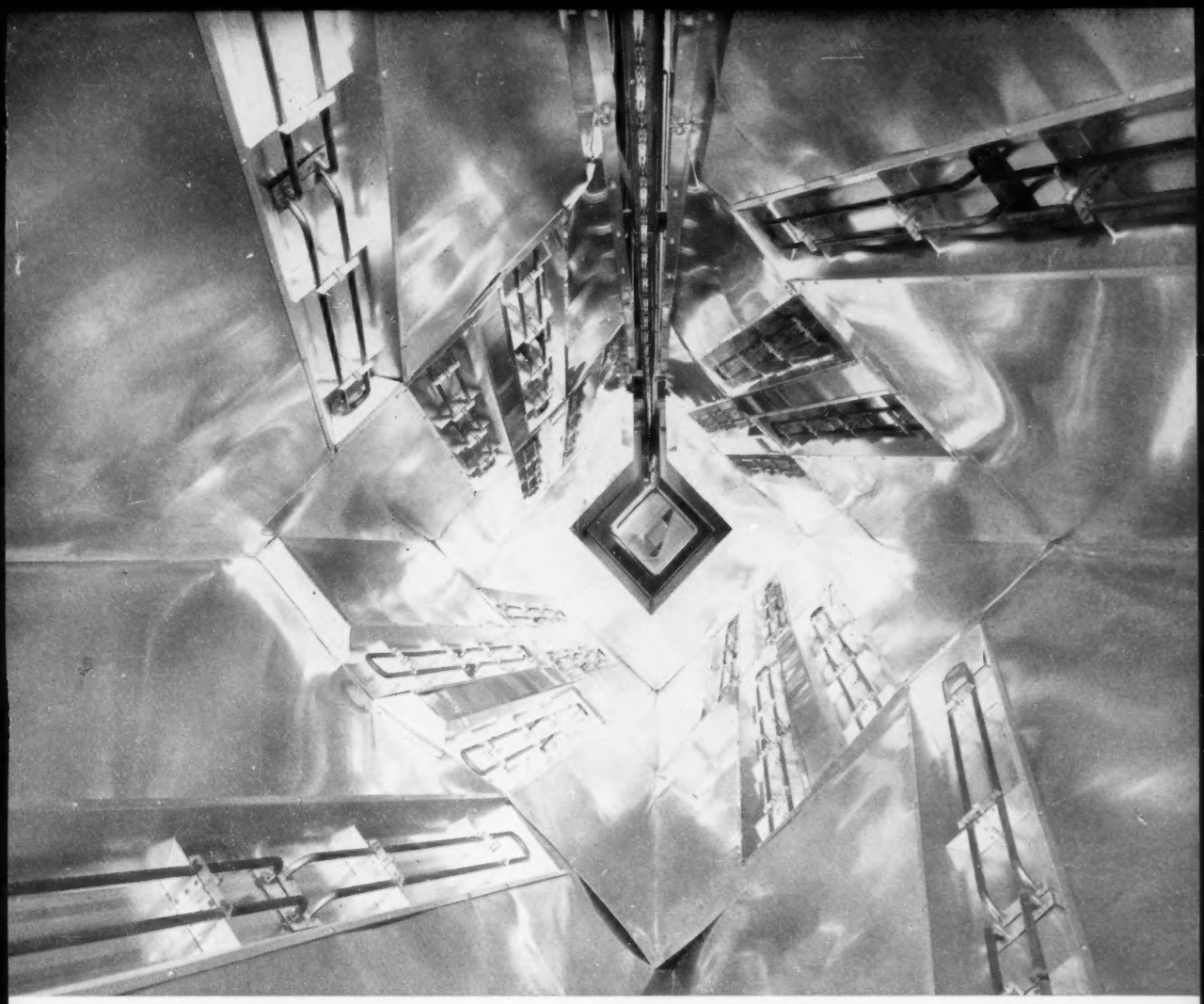
Side view of Taymouth's G-E Infra-Red Radiant Calrod Oven. Note low-cost frame work made by Taymouth's own patented channels. Oven can be disassembled and reassembled to suit changes in product design, and can be adapted to any conveyor system. Terminal box is located on back for easy wiring. Panels are 72-inches long, 9-inches wide and 11-inches high . . . weight approximately 31 pounds.

"We now handle our refrigerator cabinets from stock pile, through enameling, to assembly line in a 3 minute cycle," Mr. Kraszewski claims. This stack-drying alone was a waste of valuable space and material was collecting dust and dirt.

"The new process has eliminated rejects, too. In the old process we dipped the cabinets in a *hot* neutralizer, to speed up drying process, and we usually lost 10% in rejects due to dirt and improper drying. In addition, the neutralizer bath was kept at about 200 degrees F. twenty-four hours a day . . . whether in use or not, it cost heavily in electrical power.

"Now, we dip the cabinets once in a cold neutralizer, dry them in a Calrod Oven, paint and bake them for assembly in a 3 minute cycle. We save enamel, too. Previously each cabinet was enameled twice.

CANADIAN GENERAL ELECTRIC



Now we hot-spray paint them once and with the G-E Oven get a much better finish".

Other savings cited were: two men now do the work of four in metal preparation process; the oven is "off" until ready for use; "plug-in" elements in use about two years without replacements; oven is quickly adjustable for shapes up to 5 feet overall dimensions; and simple oven control is possible because there are very low heat losses.

For complete information on G-E Infra-Red Radiant Calrod Ovens or Panels, contact your nearest C-G-E office, or fill out and mail the attached coupon . . . today!

COMPANY LIMITED

An interior view of the G-E Infra-Red Radiant Calrod Oven used by Taymouth Industries Ltd. Bodies of panels are insulated with Fiberglas. Reflectors are made of highly reflective aluminum sheeting to reduce heat losses. Plug-in Calrod Elements are easily removable. Panels are fitted with two Calrod units, each 2, 3 or 5 KW for panel wattages of 6, 8 or 10 KW; voltages 230, 460 or 575V. Units CSA approved.

INFRA-RED RADIANT Calrod Panels

Component Heating Devices Sales 436W-655
Canadian General Electric Co. Ltd.
224 Wallace St., Toronto, Ont.

Please send further information on G-E Infra-Red Radiant Calrod Ovens and Panels to:

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COMPANY.....

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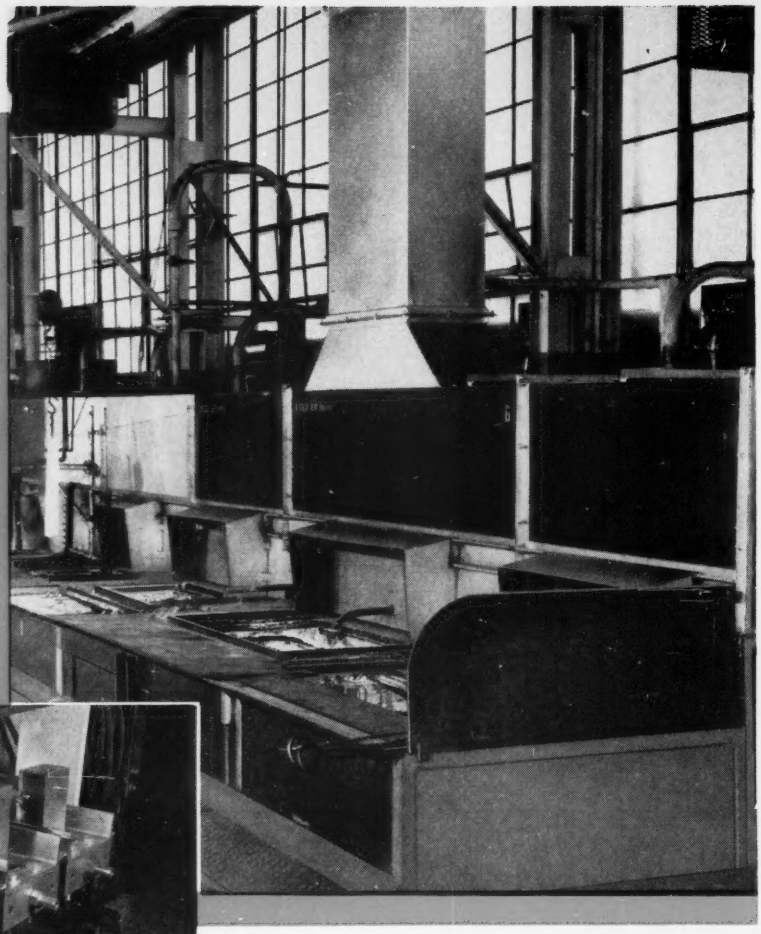
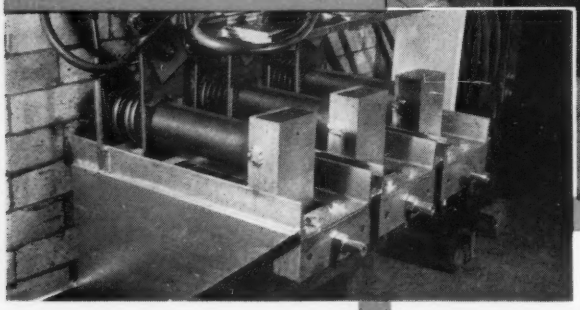
Tool Room Heat Treating





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The UPTON SALT BATH led the field with a patented, flush side-wall electrode giving unparalleled economy and ease of operation.

Now the latest development gives you a continuously replaceable graphite electrode allowing controlled temperature up to 3000°F. This new electrode reduces sludging, maintains a neutral bath and gives improved work finish.

Upton Salt Baths heat fast and clean and systems are available for heat treating all steels from low carbon to high speed grades.

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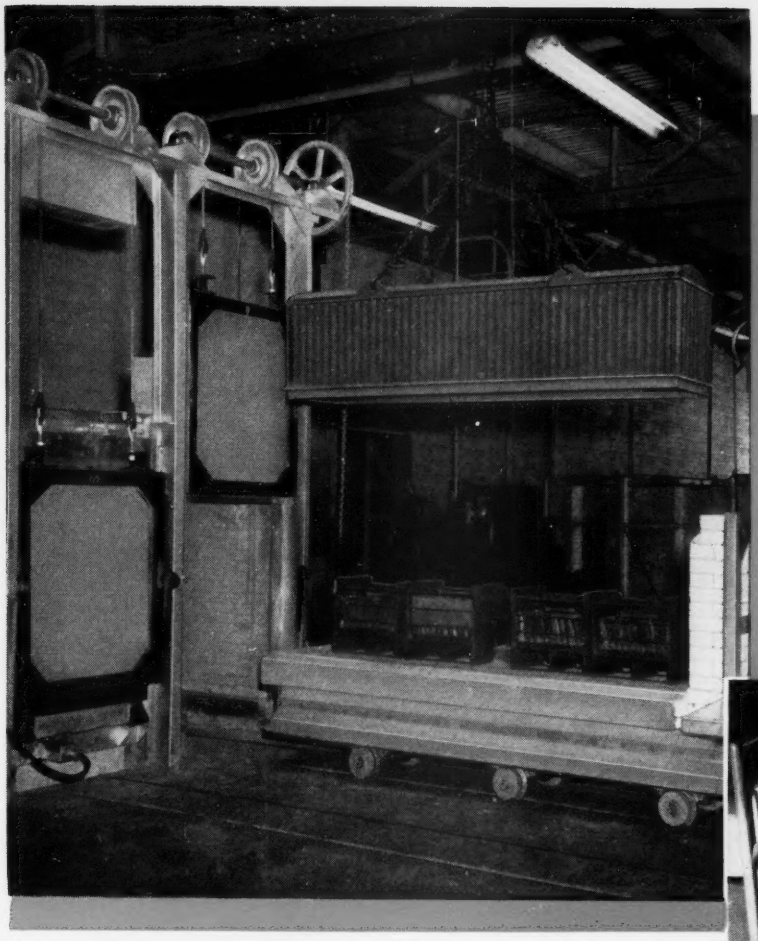

Battery of Car Type Annealing Furnace

Careful consideration to design and construction was necessary to produce this quality heat treatment.

The furnaces in this group are electrically heated and use off-peak power. The heat treatment is dead-soft annealing on bars of high carbon steel. The steel is protected by muffle, goes through a timed, soaking period and is slow cooled to a temperature below the subcritical. Once subcritical temperatures have been reached the steel is quenched to expedite handling.

CANEFCO BUILDS ANNEALING FURNACES

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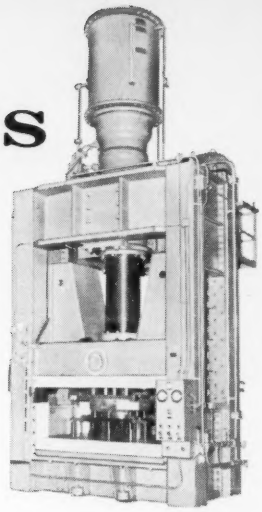
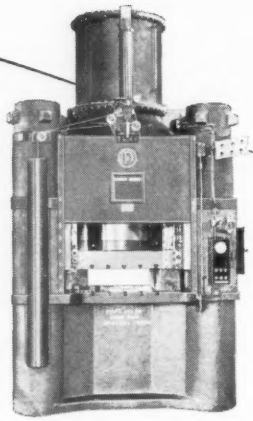
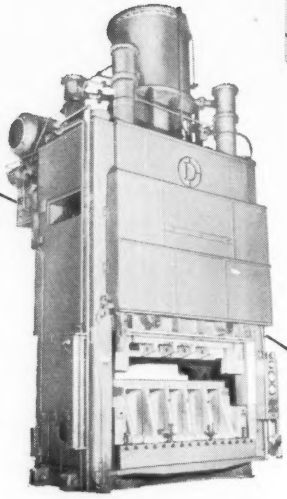
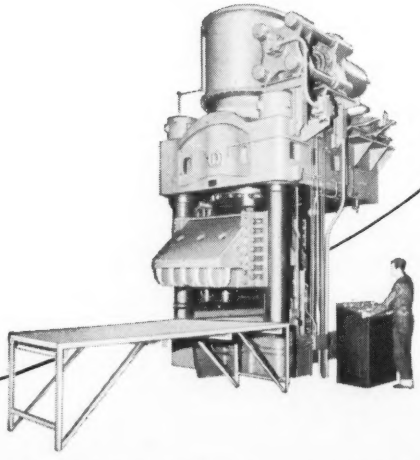
serve Canada's aircraft industry









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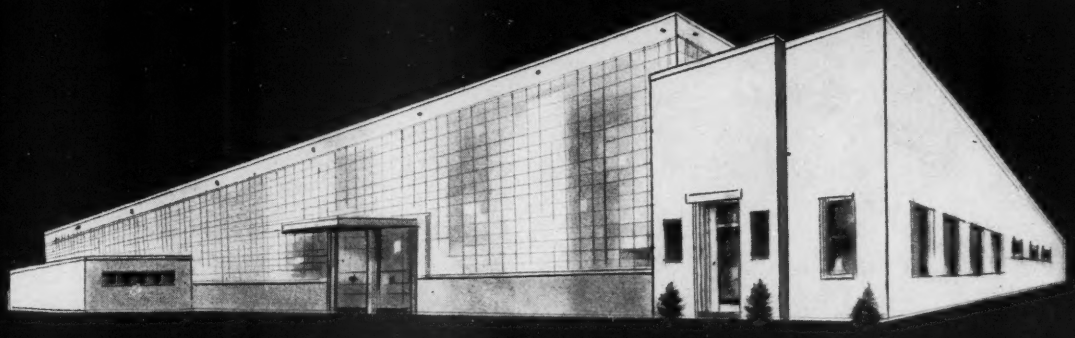
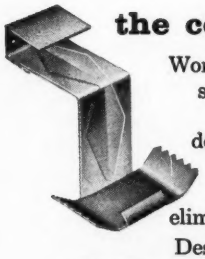


for all Canadian industry

Improved fastening methods created and developed by completely integrated Canadian company

"Imagination is given the reins" at the Hamilton plant of Dominion Fasteners Limited. Here, through a combination of up-to-date facilities and creative personnel, this Canadian company is constantly inventing, developing and producing better fastening methods for industry.

Manufacturers of the famous line of SPEED NUT brand spring tension fasteners, Dominion Fasteners Limited are always ready and able to provide any industry with an efficient and economical solution to any attachment problem.



here's an example of how

the construction industry profits . . .

Working with ROBERTSON-IRWIN LIMITED, a major supplier of steel roof deck to the Canadian construction industry, Dominion Fasteners Limited created and developed a new type SPEED CLIP for the attachment of insulation to roof deck. The precarious fire hazard associated with former methods was completely eliminated . . . as well as many other installation problems.

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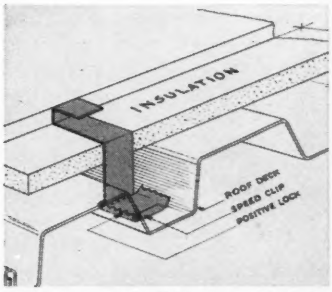

Robertson-Irwin Q-Deck mechanical insulation fastening method

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over 6000 types and sizes

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advanced thinking at

MARTIN...

uses the efficient

HEIM

Unibal

ROD ENDS

in the new *Sea Master* XP6M-1 multi-jet attack seaplane. Built for the Navy at Martin's Middle River plant, the big, swept-wing flying boat is powered by four jet engines, and is designated in the over 600 mile-per-hour class. Four Allison J-71 jet engines are equipped with afterburners to give the craft additional speed and power.

The Heim Unibal consists of a single ball, revolving in bronze bearing inserts, in an outer member of carbon steel, approved aircraft steel, or any other suitable material. They are used extensively by the aircraft industry, and were chosen by Martin for use in the fabulous, new Sea Master for their strength, efficiency, and dependability.

Heim Unibal Rod Ends are manufactured in many sizes to cover a variety of applications, other than in the aircraft industry, and fill a long-felt need for a bearing that corrects misalignment conditions, and has maximum carrying capacity because of their greater surface supporting area. They will take a greater radial and axial thrust load.

Tell us your bearing problem, and our Engineering Department will be pleased to submit their recommendations for any application.

Engineering data are complete in the new Heim catalog — please write for your copy

R/M BEARINGS CANADA LTD.

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Stelco's Engineering Service is at your disposal. If you use parts comparable in any way to those shown, Stelco can probably save you money. Your enquiry will be handled promptly by any Sales Office.

INDUSTRIAL FASTENERS INSTITUTE

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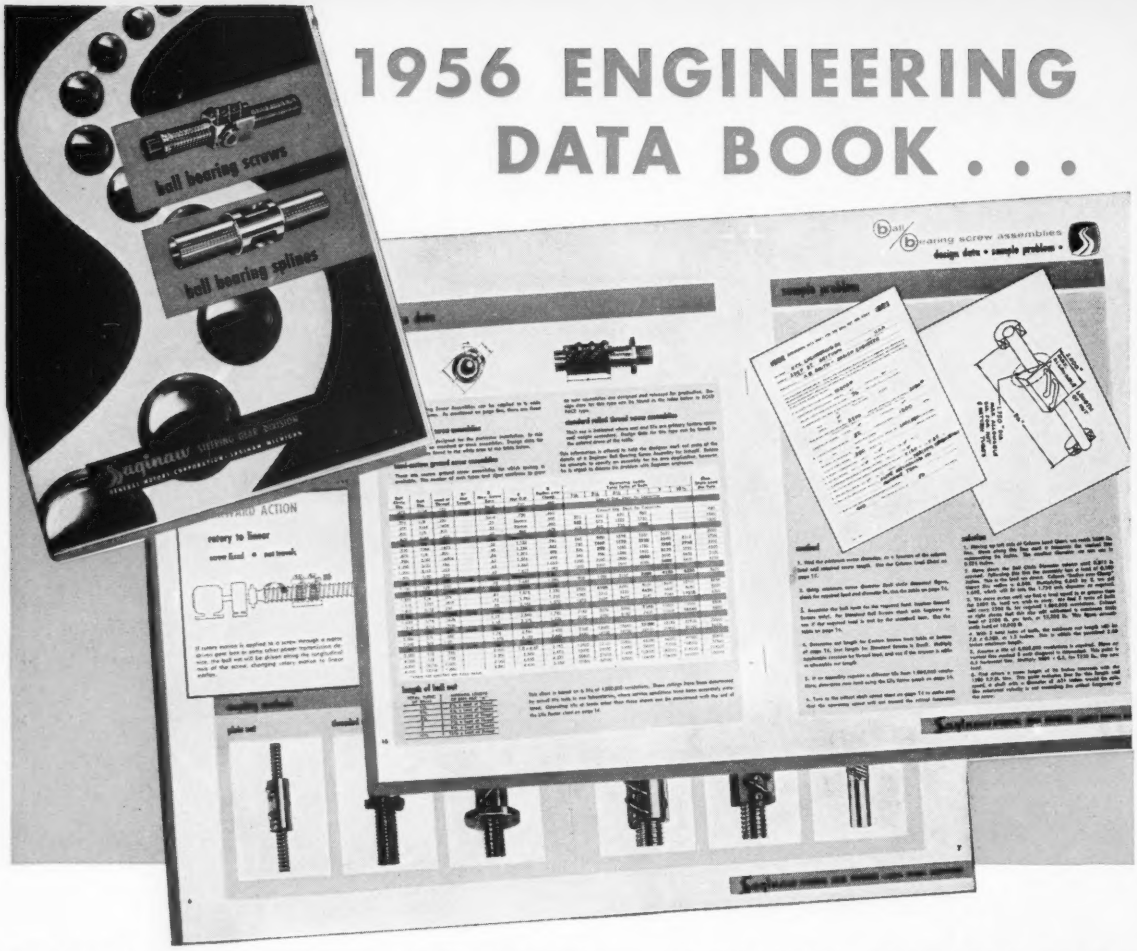
1956 ENGINEERING DATA BOOK . . .



SHOWS HOW SAGINAW b/b SCREWS and SPLINES FREE YOU FROM DESIGN LIMITATIONS OF ORDINARY ACTUATORS and POSITIONERS

BOOK CONTENTS: Principle • Types • Basic Operations • Coupling Methods • Efficiency • Versatility • Advantages • Selection Factors • Charts: Expected Life, Critical Speed, Column Load • Design Data • Sample Problem • Typical Custom Assemblies • Standard Assemblies

SAGINAW b/b SCREWS are *90%-98% efficient* (compared to 15%-20% efficiency of Acme screws). Require 2/3 LESS torque and power for same linear output—with consequent weight, space reductions. Function normally at −75° to +400° F. Two types: precision-ground or economical rolled-thread. Have been built 1½ in. to 39½ ft. long.

SAGINAW b/b SPLINES have *40 times lower coefficient of friction* than sliding splines; transmit or restrain high torque loads far better: permit vital power, weight, space reductions. Have been designed 3 in. to 9 ft. long.

Saginaw
ball bearing
Screws & Splines

SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP., SAGINAW, MICH.

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Saginaw Steering Gear Division, General Motors Corporation
b/b Screw and Spline Operation
Dept. 6W, Saginaw, Michigan

Please send new engineering data book on Saginaw b/b Screws and Splines to:

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ISOPROPYL ALCOHOL

industries' new favourite...

... and Shell IPA's solvent power, purity and high blush resistance are the reasons.

Used extensively in lacquer and thinner formulations, Shell IPA is also an excellent solvent for alkaloids, essential oils, gums and shellac. It is considered superior in the preparation of varnishes for food containers, the manufacture of pectin and as an ingredient in rubbing alcohol and in cosmetic and toilet preparations.

Be sure of your service and supply—deal with the quality petro-chemical people—the Chemical Division of Shell Oil Company of Canada, Limited.

IPA

Some other alcohols produced by Shell:

Secondary Butyl Alcohol, Tertiary Butyl Alcohol, Diacetone Alcohol, Methyl Isobutyl Carbinol, Hexylene Glycol

Chemical Division

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Sometimes it's too late to change your mind!

When a product is shipped with an inferior spring it's often too late for the manufacturer to save his customers' goodwill . . . for in any machine or appliance where you find a spring, you find motion . . . and when that inferior spring breaks down, that motion stops and the manufacturer of the product (not the spring maker!) is blamed.

We suggest you guarantee your product's good name by always specifying Wallace Barnes *quality* springs . . . known the world over for their precision and long life.

FREE BOOKLET

SPRING CHATS will keep you as informed as your competitors about new spring advances. Issued five times yearly, this booklet is packed with spring facts . . . not a lot of sales talk. A letter or penny postcard with your name and address is all that is needed.

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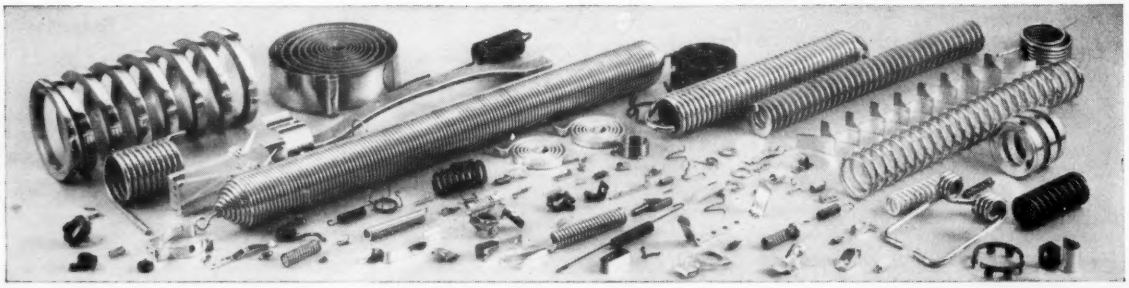

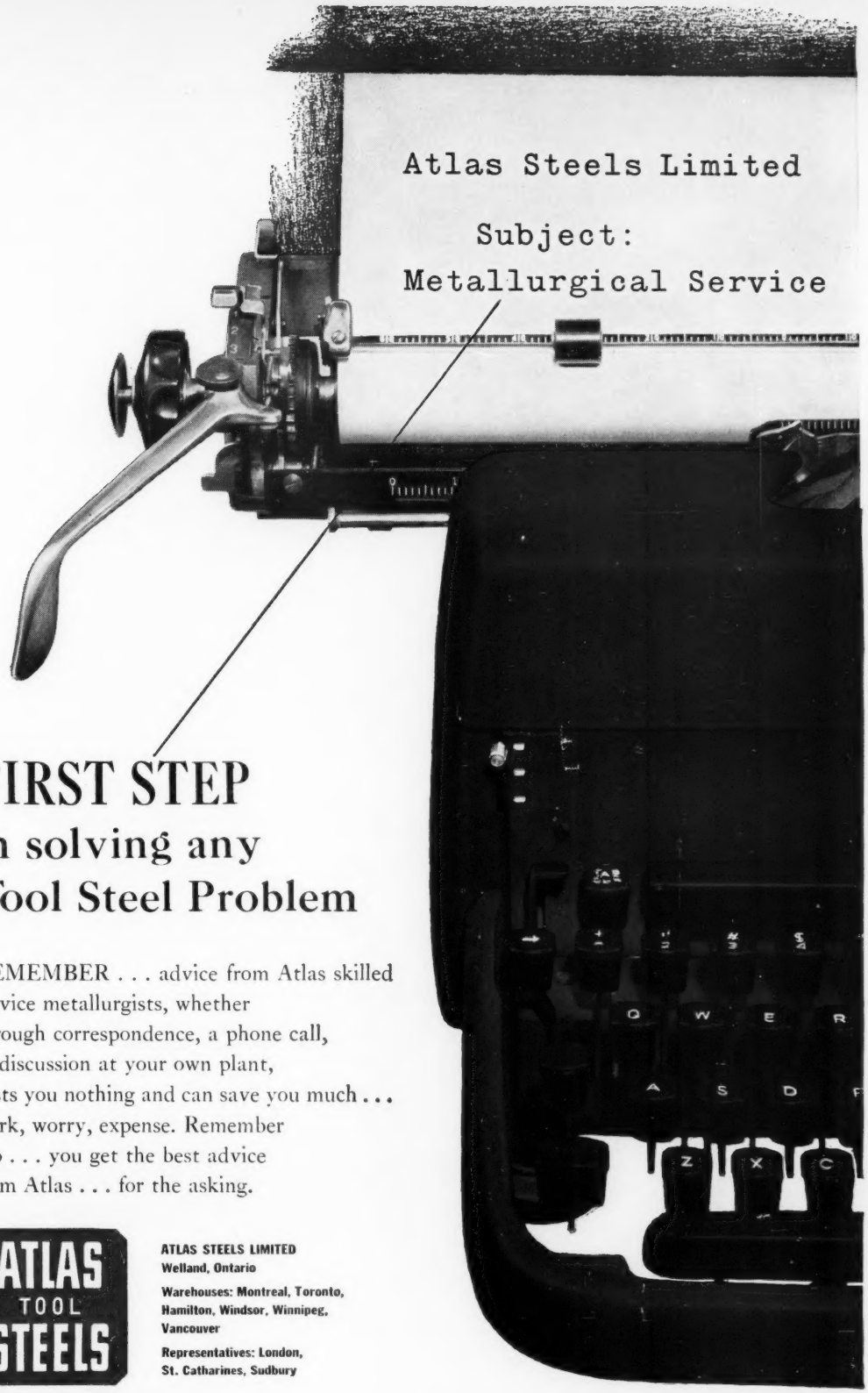

FIRST STEP
in solving any Tool Steel Problem

REMEMBER . . . advice from Atlas skilled service metallurgists, whether through correspondence, a phone call, or discussion at your own plant, costs you nothing and can save you much . . . work, worry, expense. Remember too . . . you get the best advice from Atlas . . . for the asking.

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AGENTS THROUGHOUT THE WORLD

TS13-56

Quality components

MAKE GOOD PRODUCTS EASIER TO SELL

...so in advertising and literature, these machinery builders feature

✓BLOOD BROTHERS Universal Joints and Drive Lines

Doctor, Merchant or Chief Engineer, you learn to prefer well-known products of high reputation—whether tires for your family car or component parts for your products.

These farm machinery manufacturers, too, have learned from past satisfaction that customers *respect and prefer to buy* implements with Blood Brothers Universal Joints.

So in catalogs and advertising, they *voluntarily* feature the dependable, uniform high quality of Blood Brothers Drive Lines.

Engineer, Purchasing Agent or Salesman—*you'll* find good products get extra preference (and perform better too) when they're Blood Brothers' equipped!

Write for engineering data and "Spec Sheet" Blanks.

BLOOD BROTHERS MACHINE DIVISION

ROCKWELL SPRING AND AXLE COMPANY

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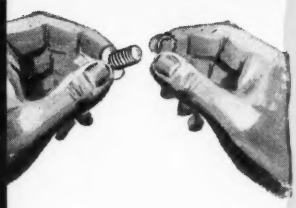
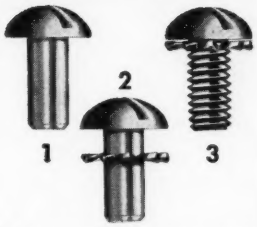
UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

Why SEMS-by-SHAKEPROOF reduce assembly costs!



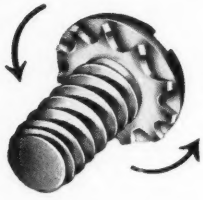
Putting lock washers on screws by hand is costly and time consuming.

With pre-assembled SEMS-by-SHAKEPROOF two parts are handled as one.

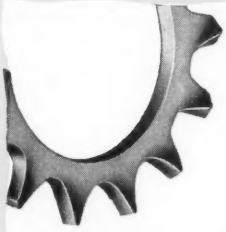


The lock washer is mechanically pre-assembled on the screw —held on by the rolled threads.

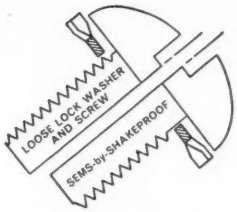
Lock washers can't drop off, can't be wasted or "forgotten."



The lock washers on SEMS-by-SHAKEPROOF always rotate freely...



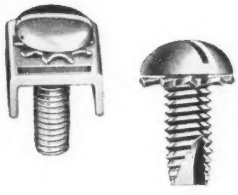
Multiple, tapered-twisted teeth give positive mechanical locking action.



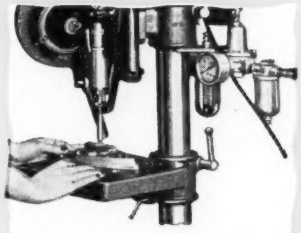
Locking teeth fit closer under the screw head for maximum locking power.

You get the best protection against vibration loosening with SEMS-by-SHAKEPROOF.

Shakeproof's complete line of standards will meet nearly every assembly need.



Specials and multiple-piece units make the range of application unlimited.



One-piece SEMS -by-SHAKEPROOF can be hopper fed for automation!

Eliminate unnecessary handling. SEMS-by-SHAKEPROOF will save time, reduce costs!

Free Sample Kit

Now... make your own tests! See for yourself how SEMS-by-SHAKEPROOF can save money in the assembly of your product. Write for your free sample kit today!

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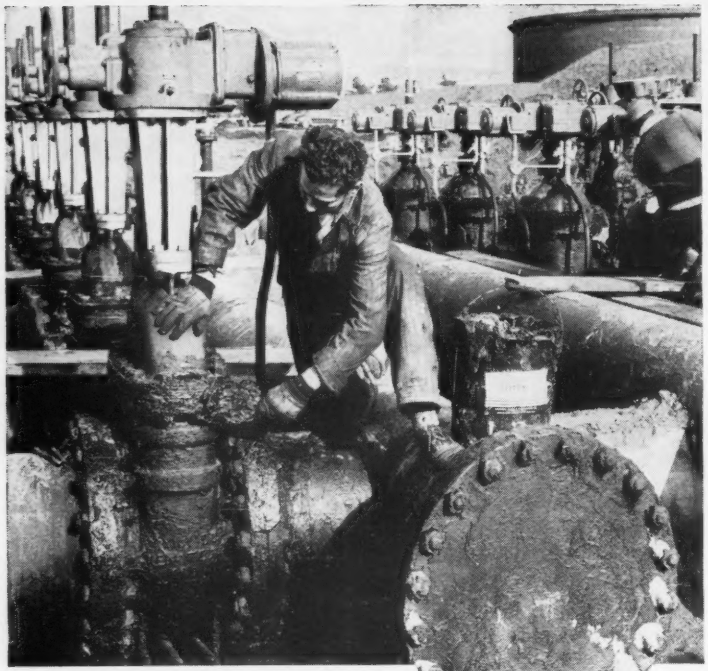
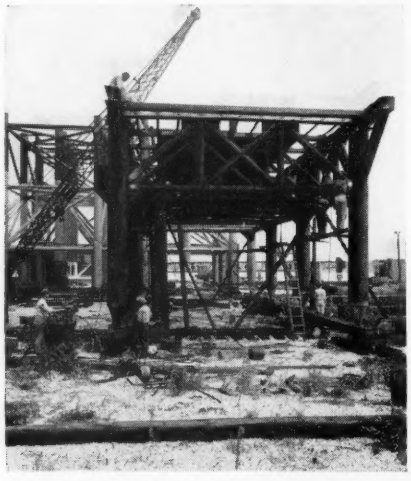


"3M" Coating EC-244 is used to protect underground manifold piping, valves, etc., against soil corrosion.

"3M" Sealers are widely used in the aircraft and automotive industries.

"3M" Adhesive EC-770 being applied to the inside edges of hot air register for bonding a felt strip gasket.



Applying "3M" vinyl protective coating to a part of an offshore drilling rig.

Solving the problems of design /

'3M' offers 1000 different types of adhesives, coatings and sealers

There is virtually no limit to the number of materials that can be joined, coated or sealed with "3M" Brand Adhesives, Coatings and Sealers. Wood, plastics, rubber, glass, leather, metal and many other types of materials, which once were joined with mechanical fasteners, are now being held firmly and permanently with "3M" Brand Adhesives. These same materials can be protected or insulated with "3M" Brand Coatings.
Gaps and voids can be closed, metal components separated to avoid galvanic corrosion, by the use of "3M" Brand Sealers. When it's a question of adhesives, coatings or sealers—consult your "3M" representative for complete information.

3M COMPANY **ADHESIVES, COATINGS, SEALERS**

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Sales Offices: **Halifax • Montreal • Toronto • Winnipeg • Saskatoon • Calgary • Vancouver**

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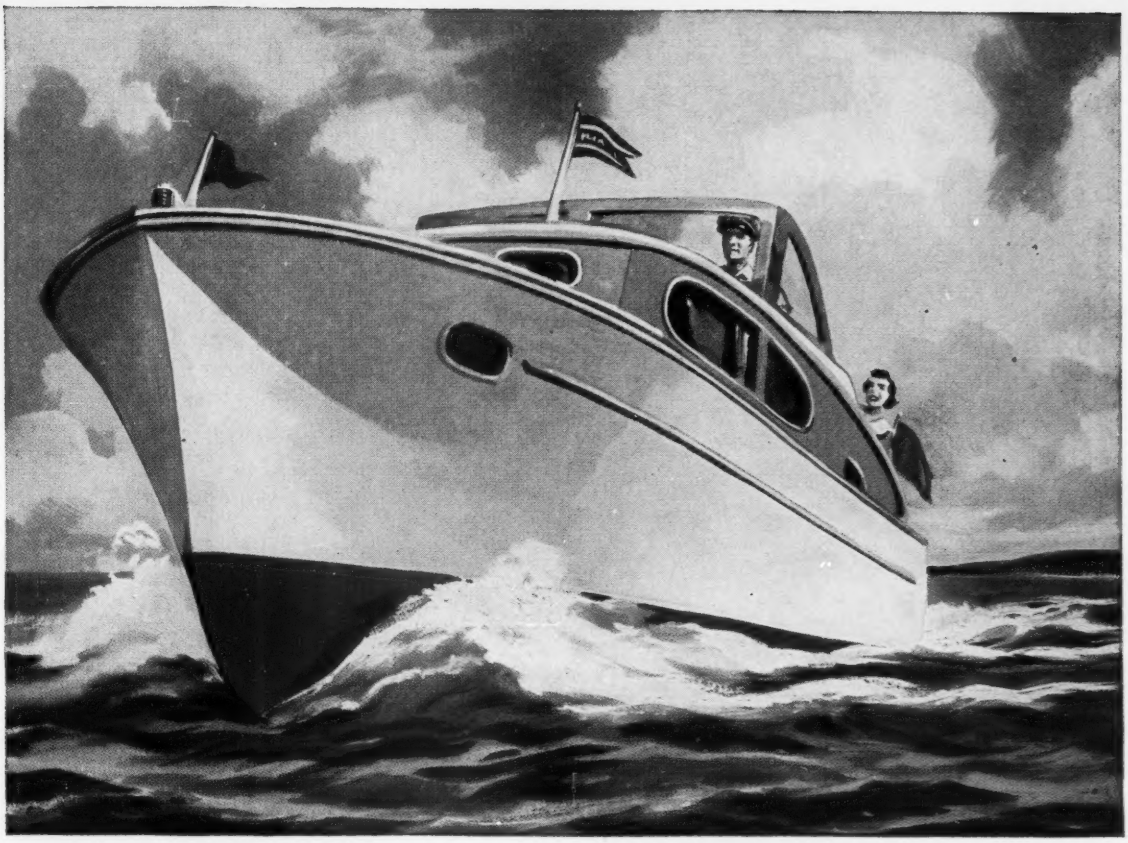


It's always a pleasure to cruise with Vibrin

FOR YEARS, the pride and pleasure of boat ownership has been offset by the high cost and hard work involved in proper boat maintenance. But now, Vibrin — key material in the building of plastic boats — has eliminated the recurring expense of scraping, painting and caulking.

Made in Canada by Naugatuck Chemicals, this polyester resin permits boat builders to make hulls that are completely watertight and rot-proof. And, because lightweight Vibrin will not absorb water, it permits greater speeds from any given horsepower.

Reinforced with glass fibres — as in plastic boats — Vibrin is many times stronger than steel, and practically indestructible. It will never rust—even in salt water. Forming is easy. Molds and tools can be inexpensive as pressure and heat are not necessary.

Vibrin is already being used in many applications besides boats: translucent structural sheeting, fishing rods, car and truck bodies, chemical piping, and aircraft parts, among others.

To find out how Vibrin can improve present products, cut manufacturing costs, and give reality to ideas which were impractical with other materials, call or write Naugatuck Chemicals, Elmira, Ontario or branches shown below.

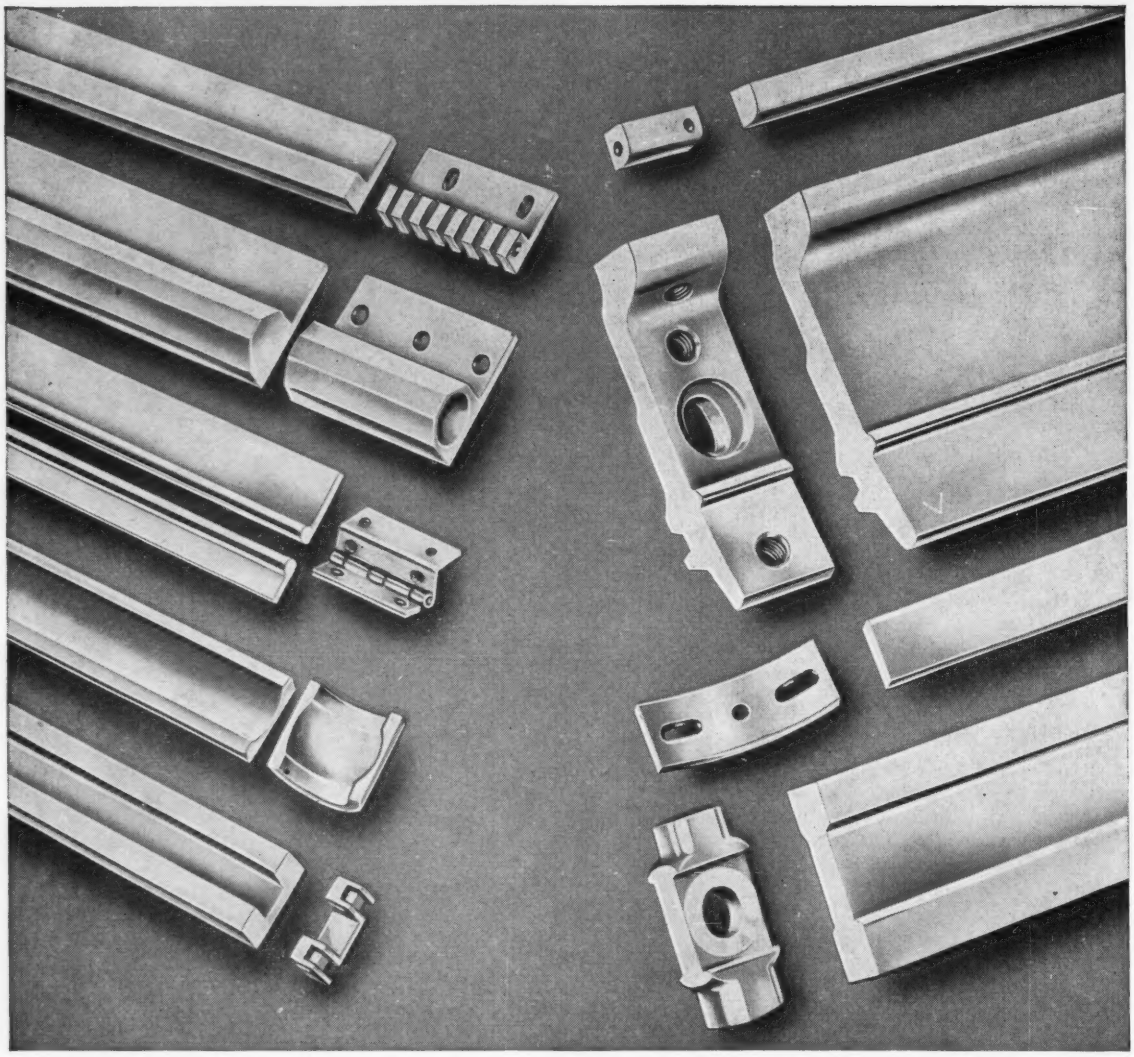
Naugatuck Chemicals
DIVISION OF DOMINION RUBBER COMPANY LIMITED
Plant & Sales: ELMIRA, Ont.
Branches: Montreal • Toronto • Winnipeg

Other NAUGATUCK Plastics:

MARVINOL
Vinyl resins offering good physicals, easy processing, low temperature flexibility, and resistance to oils, acids, wear.

KRALASTICS
Molding and extrusion compounds combining the rigidity of plastics with the tough elastomeric properties of rubber.

A SHORT CUT TO A FINISHED PRODUCT



REDUCE YOUR MACHINING OPERATIONS, REDUCE SCRAP

get a superior wrought metal product with Anaconda extruded shapes

Cost-paring possibilities unlimited: In few areas can imagination and ingenuity pay off so handsomely as when applied to the use of extruded shapes. Visualize your finished parts as cross-sectional pieces cut from a long extruded shape.

Costs come down, quality goes up: Extruded metal is *wrought* metal—tough, dense-grained, smooth-surfaced, and easy to machine. When you switch from cast parts, you eliminate rejects due to pits and porosity; you reduce machining, scrap . . . and finishing time.

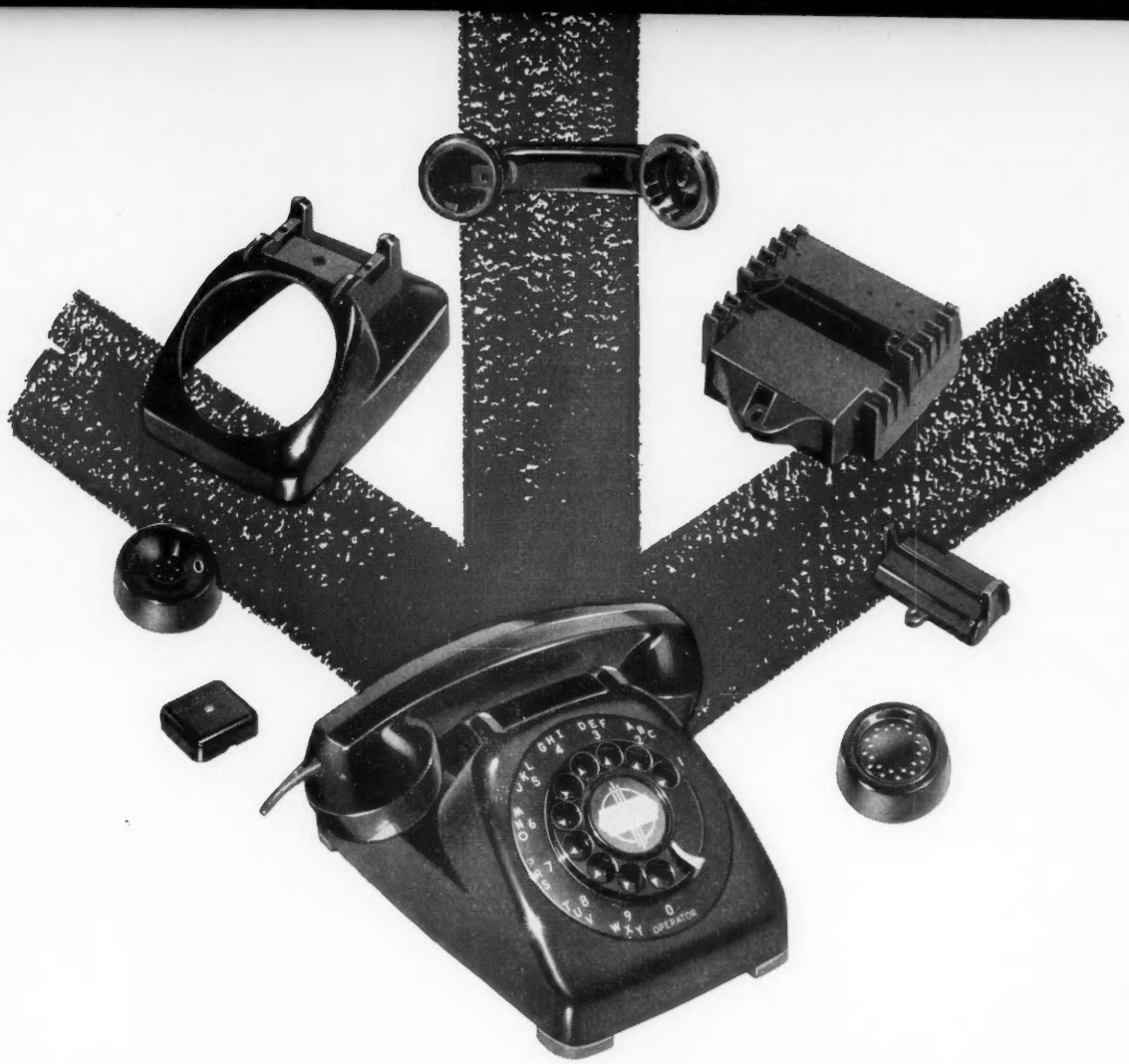
A manufacturer of hosiery knitting machines, for example, found he saved from 25-30% over cast brass. He makes 420 components from 12 different ANACONDA Extruded and Drawn Brass Shapes. He also gets the superior precision, balance, and long-wearing and bearing qualities in these parts, which must operate at high speeds.

Metals: Extruded shapes are available in copper, brass, bronze, and special copper alloys—in long mill lengths suitable for feeding into turret lathes or automatic screw machines.

Our experience at your service: The accumulated experience of this organization, its wide selection of dies, may help you shortcut production and save money.

We'll be glad to make suggestions based on your sketch or sample. Address : Anaconda American Brass Limited, Main Office and Plant: New Toronto, Ont. or Montreal Office: 939 Dominion Square Building.

ANACONDA
EXTRUDED SHAPES



Intricate molding operation performed for Automatic Electric (Canada) Limited

The Automatic Electric Type 80 Telephone, above, the second model molded for this Company . . . is typical of the repeat-order confidence customers have in Canadian General Electric.

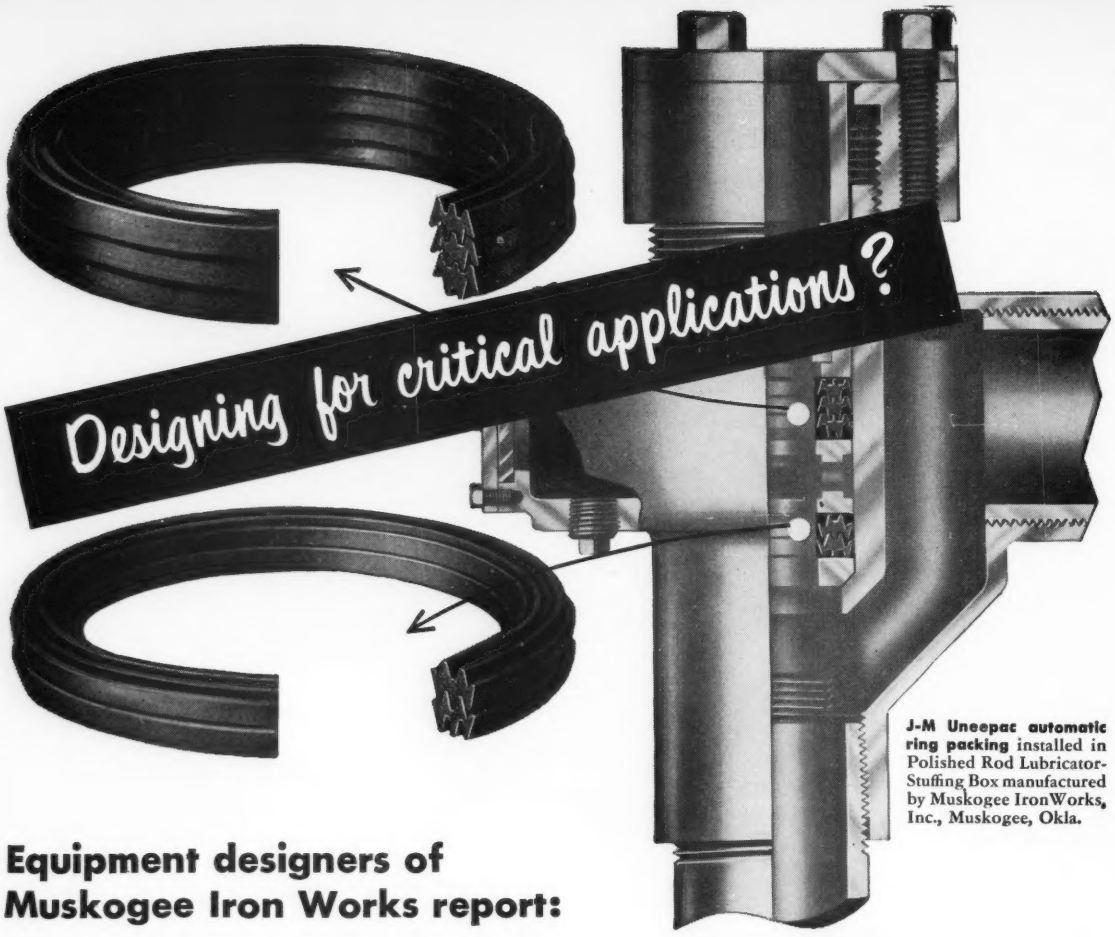
Time after time these customers return to Canadian General Electric Plastics Advisory staff with problems involving plastics. Job after job they profit from the design ingenuity, wide material and process versatility, and the experience, progressive research and practical knowledge that has made C.G.E. one of Canada's oldest, largest and busiest molders of plastics.

Plastics Advisory Service—No matter what your requirements this "specialist" Service will pay off for you, too. Whether the job calls for an entirely new material, product, or part or simply the need to improve the visual or functional design of an old product, C-G-E engineers range through every known raw material and filler, and every method of molding—injection, compression, extrusion, including automatic molding. One or all of these methods may be required to produce parts for a final product that is better made . . . at lower cost . . . with fewer rejects. *For complete information: contact Plastics Advisory Service, Canadian General Electric Company Limited, Cobourg, Ontario.*

CUSTOM MOLDED PLASTICS

451W-156

CANADIAN GENERAL ELECTRIC COMPANY LIMITED



J-M Uneepac automatic ring packing installed in Polished Rod Lubricator-Stuffing Box manufactured by Muskogee IronWorks, Inc., Muskogee, Okla.

Equipment designers of Muskogee Iron Works report:

"Greatly increased packing life... Uneepac guards against pressure damage"

FOR THEIR NEW LUBRICATOR-STUFFING BOXES, design engineers of Muskogee Iron Works needed a packing with long service life as well as foolproof operation. Uneepac, the Johns-Manville automatic ring packing, fully met both of these requirements and contributed to the success and acceptance which the equipment has encountered.

In this application, Uneepac protects itself against damage by excessive gland pressure. The lips of each ring are guarded by the projecting portion of the Uneepac Center section. As a result, far greater service life and reliability is obtainable in this application than with other types of packings.

Uneepac offers many other important advantages for use in pump rods and plungers, compressors and similar equipment. Seals effectively in a minimum of space. Operates with minimum friction. Has excellent pressure sensitivity. Uneepac provides trouble-free operation because each ring positions itself diametrically as well as vertically. Header or follower rings are not always required because each Uneepac ring is a complete, self-protected unit.

To learn how Uneepac may aid your new equipment design, too, write for booklet PK-58A. Just address Canadian Johns-Manville, 565 Lakeshore Road East, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS I-1058

DESIGNERS' DELIGHT

Almost every design problem is a problem of materials. Is the price right . . . is it strong enough . . . light enough . . . colourful and bright enough? Can it be cheaply formed and produced at speed . . . is it resistant to corrosion, rust, denting or scratching?

That's why so many design problems simply cease to exist when the designer begins his planning with a full appreciation of what can be done with Fiberglas Reinforced Plastics.

F.R.P. could be the answer to your problem

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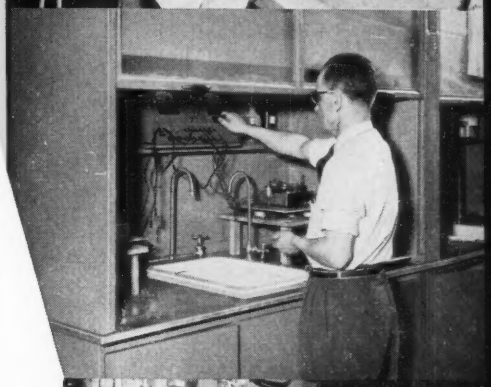
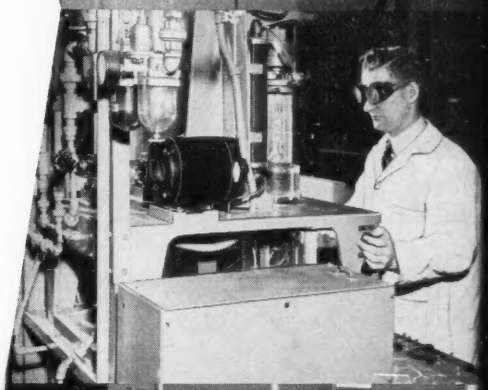
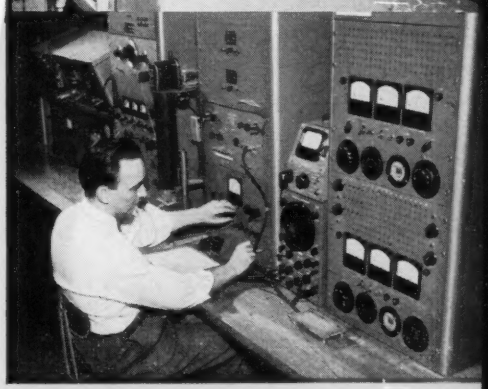
IT'S AMAZING THE DIFFERENCE FIBERGLAS MAKES!

ATTENTION! designers and manufacturers







interested in SILICON and GERMANIUM devices?

From raw materials to finished product, all processes are under our rigid control to ensure uniformity and high quality. We have the "know how" and facilities for making Transistors and Diodes to meet your specific requirements. We can render assistance in basic circuit design problems. Let us help you.

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Northern Electric
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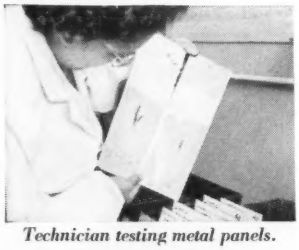
2056-1

Photo courtesy of Steel Equipment Co. Ltd., Pembroke, Ont.

C-I-L FINISHES *add warm beauty to the strength of steel*



Technician testing metal panels.

Spraying C-I-L finish on Steel Desk

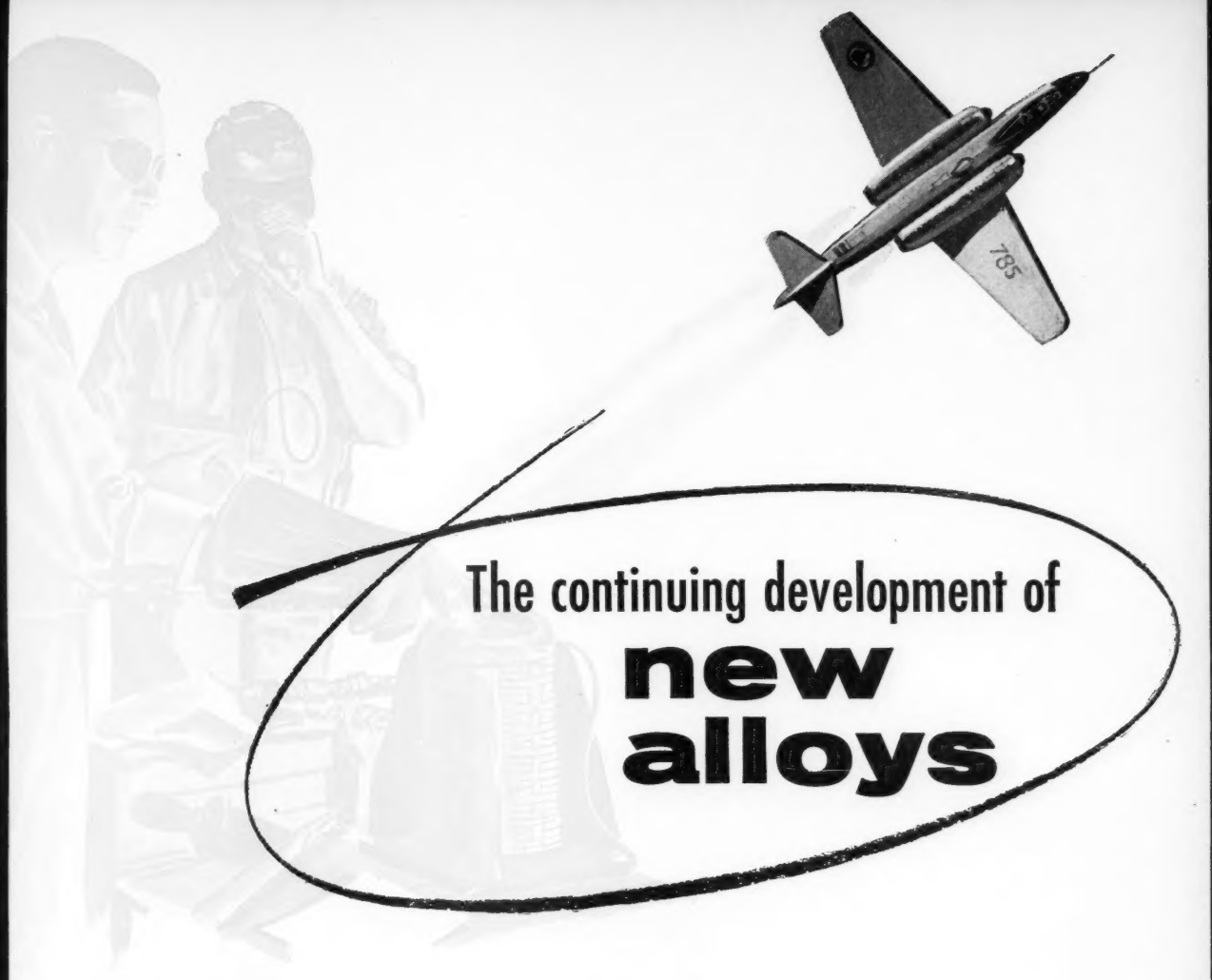
To enhance the appearance of their handsome office furniture, STEEL EQUIPMENT CO. LTD. relies upon C-I-L finishes. For on steel as well as wood, a C-I-L finish assures a wear-resistant surface of enduring beauty. C-I-L finishes are used on an amazing variety of wood and metal products . . . from pencils to pianos . . . from wires to washing machines.

To serve Canada's ever-expanding industry, the C-I-L Paint Research Laboratory is constantly engaged in developing improved finishes and finishing methods. Whether you make fine furniture or production-line merchandise, there's probably a C-I-L finish to meet your specific needs.

For Technical Information Bulletin No. 87 — Baking Metal Furniture and Cabinet Enamels — write: Canadian Industries Limited, Paints Division, Dept. 305 Box 10, Montreal, Que.

industrial finishes

C-I-L PAINTS



The continuing development of new alloys

For many years, the aeronautical industry has made extensive use of nickel-bearing materials—at first because of strength requirements (i.e. landing gear steel) and then for specialized applications such as exhaust manifolds, where high temperature properties of Inconel* are giving outstanding service.

JETS SPUR DEMAND

With the development of the jet engine, the use of high-nickel-containing materials really came to the fore, these alloys being used in such essential components as blades, wheels and flame tubes.

NEW ALLOYS DEVELOPED

The development of the high-nickel blade alloys to parallel gas turbine improvements illustrates how Inco has met immediate problems and how effort is being put forth to better its alloys of the moment. Blades for Canada's first jet aircraft engine were of Inconel "X"*. As the engine improved a new alloy, designated as 550—a modified type of Inconel "X"—was produced to meet more severe requirements. At the moment there is Alloy 700—a new type of material with excellent properties at elevated temperatures. *And the search is continuing for better alloys.*

TURBINE WHEEL MATERIALS

The same story holds true for the development of turbine wheel materials. Here, the alloy currently being offered is designated as Alloy 901. This material also has promise in the rolled condition and should find application when elevated temperature properties are required in both engine and airframe construction.

U.K. OPERATION

Nimonic alloys produced by our affiliate Henry Wiggin & Company, Limited, in the United Kingdom, have found wide acceptance in aircraft components operating at elevated temperatures. Here, too, the story has been one of continual development of new alloys in order to meet designer demands.

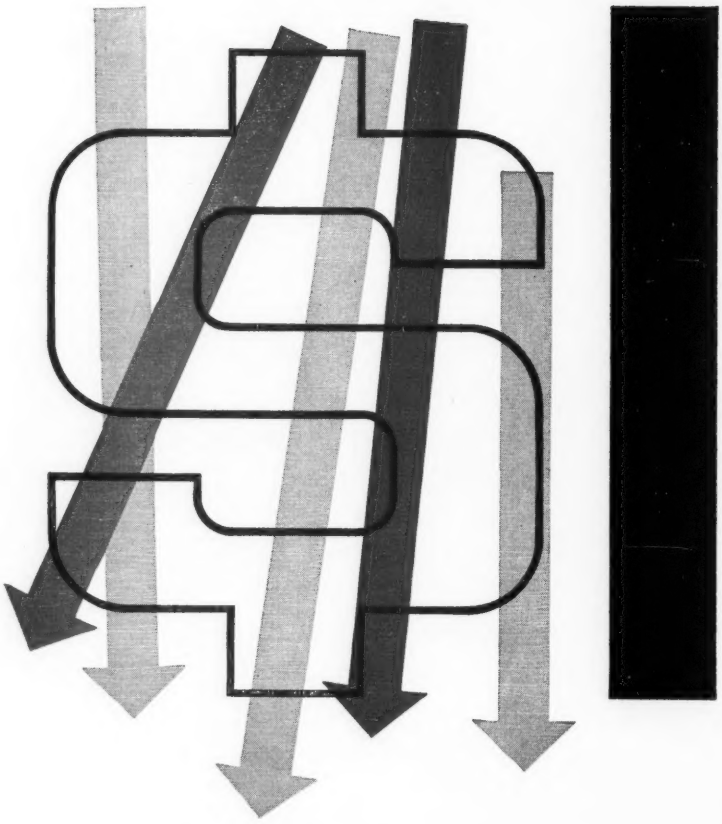
THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED
25 KING ST. W., TORONTO, ONTARIO

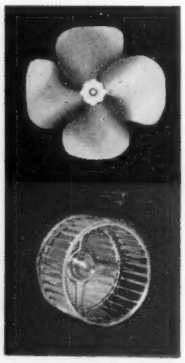
CLOSE TO THE 4 BILLION DOLLAR MARK

Torrington air-impellers are contributing to the quality and saleability of products valued at nearly $4 billion a year. A partial list of product categories:

Room air conditioners
Automobile heaters and air-conditioners
Cooling towers
Commercial coolers
Window ventilators
Kitchen fans
Hassock fans
Electronic cooling devices
Space heaters
Oil burners
Unit heaters

If you have a design or manufacturing problem involving air-impeller equipment, Torrington's industry-wide reputation is your assurance of quality and service.





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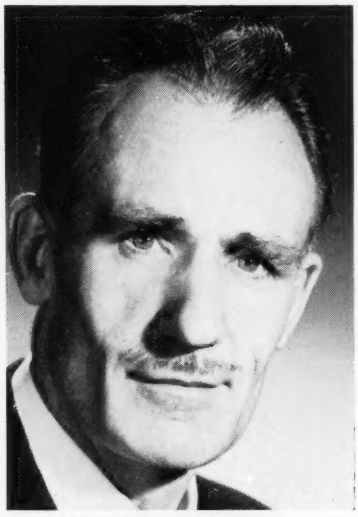
People

Important people who are in the news

WHEN Standard Modern Tool Co., bought the long-established A. R. Williams Machinery Co. last year, R. E. (Bob) LAWRENCE, manager of the Williams machine tool department, went with it as part of the deal. Now his new employers report that they have already found him a good enough part to promote. While retaining his managership of the machine tool department, he has been lifted to the job of sales manager for the whole of the A. R. Williams subsidiary.

He was born in England in 1907, came to Canada in 1923. Despite the 33 years that have passed since he left the old



"All-Canadian" Bob Lawrence

world, his voice is still no more than three quarters Canadian, one quarter English. The mixture is well known to many big machinery users throughout Eastern Canada. "You are an Englishman?" suggested one caller recently. "I am a Canadian, sir," was the answer. "It says so on my passport."

Bob Lawrence knows most of the answers to questions on all manner of automatic machinery, turret lathes, drilling machines and hydraulic presses—but dislikes claiming to be any kind of expert. "I have some knowledge in a superficial way," he says. "I feel that when you think you know everything, you can be sure you are headed for trouble."

But with 27 A. R. Williams years of experience behind him and the help of staff engineers and technicians, he finds himself giving advice to customers with production problems besides selling them equipment. "We work like this," he explains. "Someone comes in, throws an article on the table and says, 'I want to make 10,000 of these a year.' So I sit down with my cohorts here and we work out a way to do it—and pass the information on."

He likes it to be known that although it finds itself with a new parent, A. R. Williams (which has two sister companies: A. R. Williams Machinery Western Ltd., and Pacific Tractor and Equipment Ltd.) still runs its own affairs and dictates its own selling policy. It Standard Modern Tool began manufacture of some machine in competition with one of A. R. Williams long-standing suppliers, would the older line be discontinued? Bob Lawrence thought about the question before giving a cautious answer. "Not necessarily," he said. "Let's just say that consideration would be given to it."

• • •

Top level changes at Atlas

ROY H. DAVIS, founder of Atlas Steels Limited, has become the first chairman of the board, and H. GEORGE DE YOUNG has been named president of the company at an election by the Board of Directors following the annual meeting of shareholders.

Under Mr. Davis' vigorous management, Atlas Steels has grown from a small tool steel company employing 35 men to one of world-wide proportions and varied specialty steel products with an employment roll of more than 2,100.

Mr. De Young, by his election, becomes only the second president to serve Atlas Steels since its organization in 1928. His rise has been rapid since he joined the Company as Works Manager in 1951. Successively named vice-president operations in 1952 and a director, he became executive vice-president in 1955.

The careers of the two men have a number of parallels. Both were born in the U. S., both graduated from the U. S. Naval Academy and both have had long experience in the specialty steel industry in the States before coming to Canada.

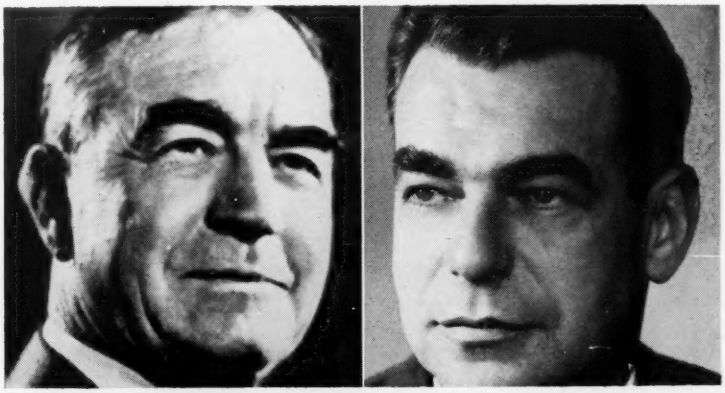
Mr. Davis is a native of Amity, Oregon, who became a Canadian citizen in 1935. He was educated at the University of Oregon and at the Naval Academy from which he graduated in 1909. He is married, has one son, Richard M. Davis (a director of the Atlas Company and its director of sales) and three daughters.

After special naval ordnance work and tours of duty with the Atlantic Fleet, Chairman Davis resigned his commission in 1913 to join the U. S. Coal and Coke Co., Gary, Indiana. In 1915 he joined Washington Steel and Ordnance Co. and in 1917 became general manager of Firth Sterling Steel Co., McKeesport, Pennsylvania. From 1923 to 1928 he was manager of the Parks Works of Crucible Steel Co. of Pittsburgh.

Business and holiday trips to Canada convinced him of the tremendous potential for industry in Canada. In 1928 he acquired control of a small tool and specialty steels company at Welland, the Canadian Atlas Steels, and laid the foundations for the growth of the present company.

The new company grew in the teeth of the depression and prior to World War II had attained nationwide status in Canada — and was selling products abroad.

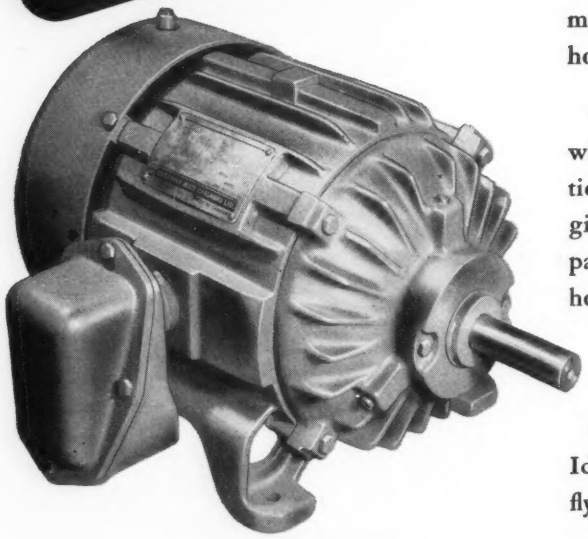
Greatly expanded during the war to serve Canadian and allied war needs, Atlas reconverted to peacetime operations afterward and diversified its specialty steel products. In 1949 it began pioneering in stainless steel production to give Canada its only domestic source for these steels, at the same time continuing its research and development of other specialty steels.



Atlas founder Roy H. Davis (left) and successor H. George de Young

Dust and Dirt Can't Clog This Motor!

ALLIS-CHALMERS MOTORS



Totally Enclosed Fan-Cooled (shown) and Explosion-Proof motors carried in stock in wide range of sizes for immediate delivery.

Whether your requirements call for the Explosion-Proof or the Totally Enclosed Fan Cooled motor, you'll find the A-C Rib Type cooling system cuts maintenance costs to a new low. Because when the fan blows cooling air over exposed ribs, it also blows dirt and dust away. Materials that may adhere to the surface can be removed quickly, easily with an air hose or by wiping.

You can mount these motors anywhere — even in hard-to-reach locations — with no worry about clogging. Elimination of enclosed air passages prevents build-up of heat-holding dust and dirt inside frame, improves efficiency over longer periods of operation.

Rugged, cast-iron construction. Ideal for use where there is dirt, dust, fly ash, rain, snow, or corrosive gases.

For complete information contact your nearest CA-C Sales Office or write direct to Canadian Allis-Chalmers Ltd., P.O. Box 37, Montreal.

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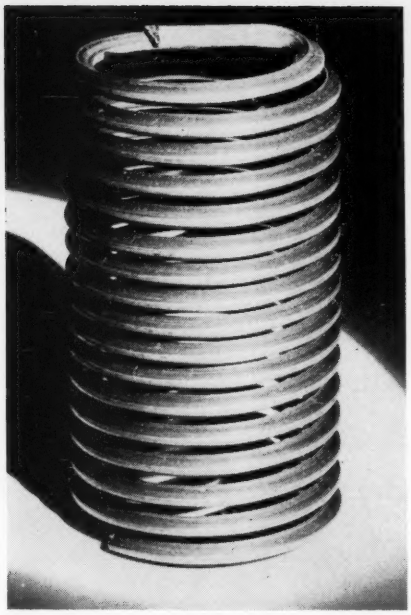


A typical standard wire thread insert. In light duty materials it gives strong fixing.

How to avoid those stripped threads

For hard-wearing threads in soft materials, try using wire inserts

By Paul Wolfe HELI-COIL CORPORATION

One of the regular problems engineers have to face in developing or redesigning assembled products (particularly in aluminum, magnesium and plastics) is how to choose the most effective fastening methods. Improperly designed threaded fastenings are often the cause of failure in products using new materials or design techniques.

Standard wire thread inserts are today widely used to solve fastening problems. Coiled from 18-8 stainless steel wire of diamond cross-section, inserts are manufactured to standard thread specifications. By protecting and reinforcing threads in the parent material, wire thread inserts offer the following advantages:

1 Higher loading strengths.
2 Resistance to frictional wear.
3 Resistance to vibrational wear.
4 Resistance to corrosion.
5 Resistance to galling and seizing.
6 Savings in weight and space.

Standard wire thread inserts provide higher loading strengths than standard tapped threads in the same material. Because they are flexible, the inserts adapt themselves readily to the receiving threads of the tapped hole, so compensating for angle and lead error. The resulting increased thread flank engagement distributes the load over the entire threaded assembly. Increased

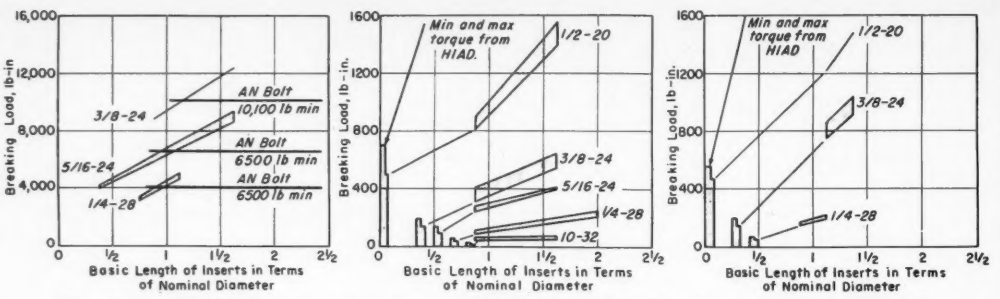
How to use an insert

Threads tapped in soft materials (like aluminum) wear fast and strip easily if much assembly and disassembly goes on. This can be overcome by the use of stainless steel wire inserts placed in the soft metal body.

There are three steps to the insertion. **First,** a hole of the correct diameter is drilled. **Second,** threads are cut with a Heli-coil tap—ready for the insert. **Third,** the insert into the tapped threads with a manual inserting tool. And there it is.

Permanent, wear-resistant threads of stainless steel ready for quick, safe fixing and unfixing are the result.

What insert protected cast magnesium threads will do



Tensile results C-T6 (left), torsion tests on 356-T6 (centre) and torsion tests on C-T6 (right).

Wire thread inserts *(continued)*

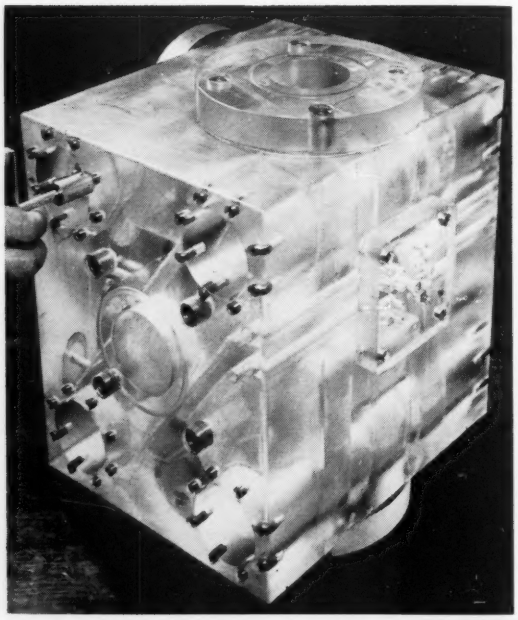
strength in both tension and torsion is produced.

Insert-protected threads averaged from 10 to 25% stronger in tension and 15 to 30% stronger under torsion than standard tapped threads in tests conducted with standard AN bolts and 24 or 17 ST aluminum. Moreover, while tapped threads often failed in unprotected holes, bolt failure usually occurred first in specimens protected by inserts. A comparison of the tensile strength of insert-protected threads against that of standard threads for 10-32 size tapped in 24S-T4 aluminum, shows that the protected threads are stronger in every case. Average increased strength attributable to the insert is 21%.

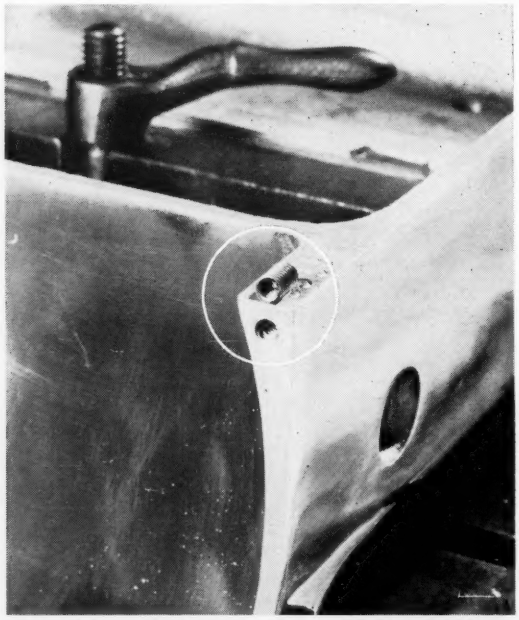
The ability of standard inserts of various sizes to develop thread tensile and torsional strength in magnesium and aluminum is shown (see diagram). Tensile load at failure of the threads is plotted against insert length in diameters. The horizontal lines indicate the minimum tensile strength of AN bolts (125,000 min. UTS) of the specified size. It can be seen that the inserts develop the minimum tensile strength of the bolt with less than 1½ diameters of insert length engaged.

It can be seen that the installation torque at which the insert-protected threads fail exceeds the maximum "installation torque" recommended by the handbook of instructions for aircraft designers, represented by the vertical columns at the lower left. For example, with inserts one diameter long, the torque at failure can be from 1 to 2 times as high as the recommended maximums, and from 2 to 3 times as high at 1½ diameter engagement.

Although wire thread inserts are most commonly



Plastic threads in this water softener valve failed under pressure test — until strengthened by inserts.



One insert is inside the hole — another (identical) above it. Note the thinness of the aluminum section.

used in aluminum and magnesium, primarily in the aircraft industry, they provide additional thread strength in a broad variety of engineering materials. Installed in the acrylic flow valve of a water conditioner (American Water Softener Co., Philadelphia), inserts are almost double the strength of the plastic threads. Unprotected threads tapped in the plastic valve could not withstand tests at required pressures up to 200 psi — exerting a 320 lb tensile load on each screw. Installation of 124 inserts in this 4-in. valve (see diagram) strengthened the threads so that they sustained test pressures without failure.

Metal is rolled to form the inserts, therefore they have a much smoother, denser surface than standard threads which are cut from metal. Because they have a hardness of 43-50 Rockwell C and a surface finish of 8 to 15 microin., they are virtually immune to wear and cause less frictional wear of mating surfaces than do tapped threads. As a result, inserts are valuable components of assemblies which must be disassembled periodically for servicing and inspection.

Qualheim Inc., of Wisconsin, solved a vexing thread repair and service problem in their aluminum vegetable cutter and slicer by the use of wire thread inserts with only minor changes in production methods.

Because light weight and resistance to attack from food acids are of primary importance, the Qualheim electro-cut vegetable cutter and slicer is made entirely of aluminum except for the stainless steel slicing knives.

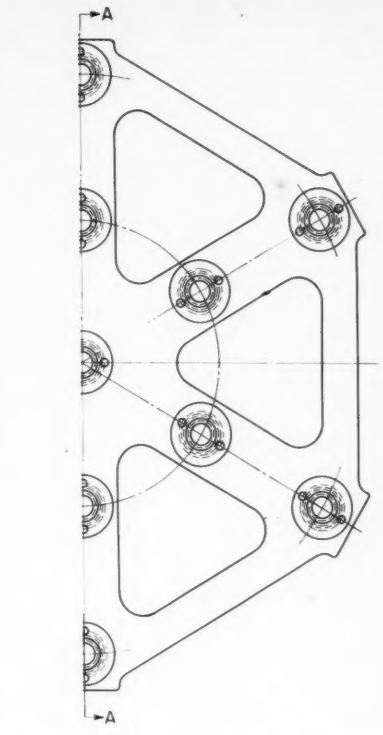
The covers of the machine must be removed 3 or 4 times daily to avoid contamination of one vegetable by another and to clean the interior thoroughly.

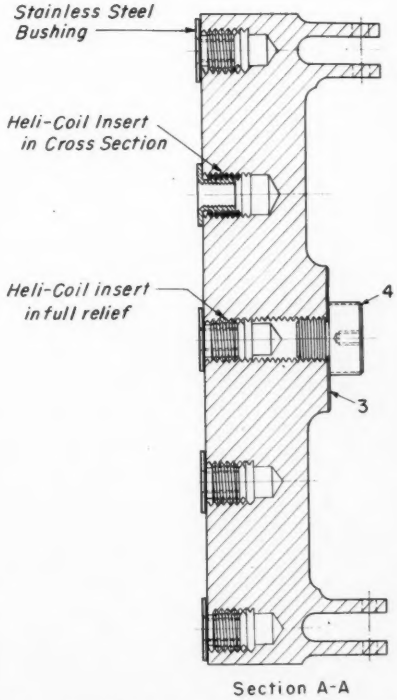
As the machine was first designed, knurled steel screws with 10-24 threads were screwed into unprotected aluminum threads in the main casing. The frequent disassembly for cleaning soon wore the aluminum threads until they were stripped. Inasmuch as a one year performance guarantee is customary in the industry, thread repair costs were running very high. Because of the thin sections required, it was not possible to substitute oversized screws or to plug and tap new threads. It was sometimes necessary to scrap a casting valued at $100 because of stripped threads. Constant removal of the cover for cleaning no longer wears the aluminum threads because they are now protected by the inserts. A total of 12 inserts are installed in the slicer.

The dead handle of a portable air tool (Rotor Tool Company of Cleveland—see diagram) is removable and can be used in either of two positions depending on the operator's preference. Threads tapped into the tool's magnesium body casting to hold the dead handle did not wear satisfactorily. The threads were often stripped in the process of removing and replacing the handle. Installation of 5/8-18 wire thread inserts in the two tapped holes which receive the handle solved the problem and materially improved customer relations.

Because the insert locks itself in the tapped hole, it is used extensively to prevent thread wear caused by equipment vibration. During installation the coiled insert is prewound to a smaller diameter. When released from the inserting tool, a spring-like action expands the insert against the tapped threads and it locks firmly in place. At the same time the insert's inherent flexibility allows it to accommodate itself to irregularities in the mating male threads so that no movement occurs between threaded components.

The specimen table of the vibration exciter made by the MB Manufacturing Co., Connecticut, is equipped with wire thread inserts. The table is cast magnesium



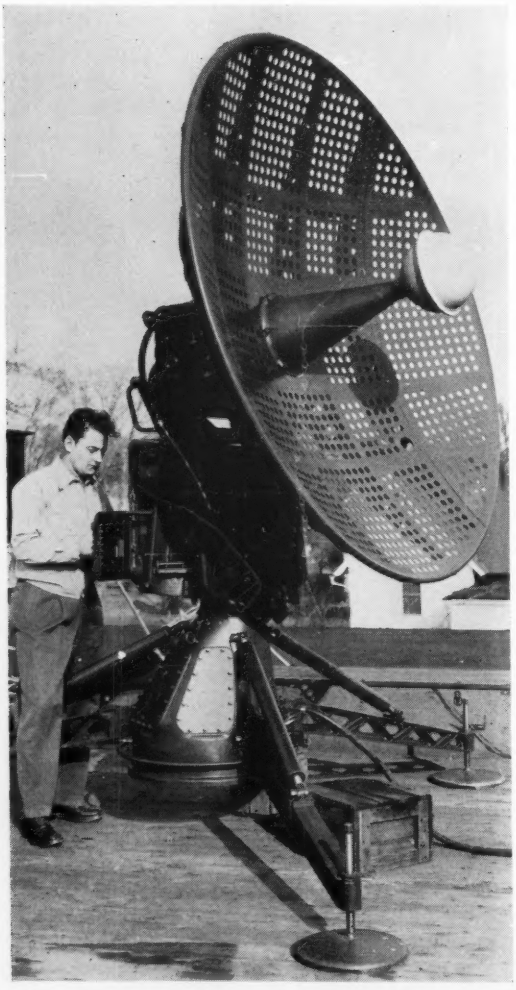


This magnesium table vibrates at 2,000 cycles per sec. Inserts hold specimens safely to it.

Wire thread inserts *(continued)*

for light weight and the specimens are bolted to the table. The table vibrates as fast as 2,000 cycles per second at acceleration forces around 10g. In addition the specimens are constantly being changed which requires wear-resistant threads.

Extensive tests have been conducted to determine the effect of unplated wire thread inserts and galvanic corrosion between dissimilar metals. The inserts were tested in C-T6 cast magnesium and 356-T6 cast aluminum. The aluminum specimens were surface-coated with either Iridite 14 or 14-2 and the magnesium with Iridite 15 or Dow 7. AN bolts were torqued according to USAF instructions and lacquered as prescribed by military specifications. The magnesium specimens were subjected to 200 hours salt spray and the aluminum to 500 hours. No galvanic corrosion occurred in any portion of any of the assemblies whether in a blind or through hole and regardless of whether the surface coatings were applied before or after insert installation. In addition, there was no sign of corrosion.



Inserts resist corrosion — one reason why they were used in this radar scanner's cast aluminum housing.

Resistance of inserts to atmospheric corrosion was a major factor in their being incorporated in the cast aluminum housing of a radar scanner (Allan D. Cardwell Co., Connecticut—see diagram) used to track and receive radio transmissions from a balloon-borne radiosonde transmitter. In use outdoors in various climates the scanner must be able to withstand alternate freezing and thawing temperatures in the arctic and sub-arctic and the sea air of coastal areas. Unprotected threaded holes deteriorated rapidly under these conditions, while the stainless steel inserts completely removed this corrosion problem.

The hard, dense, smooth surface of the stainless steel thread inserts render them immune to seizing and galling. Standard stainless steel inserts can withstand temperatures up to 800 deg F without ill effects and offer a solution to problems of seizing caused by exposure to high temperatures.

Inserts are used in such devices as induction furnaces, tire molds to eliminate galling and seizing which previously occurred as a result of the high temperatures.

Two ways to reduce space and weight requirements are provided by the use of inserts. Having no wall thickness they are smaller in diameter than solid bushings and require less space for installation. Inserts can be installed in a boss of the same diameter required by standard tapped threads of the same size. In addition, their ability to strengthen threads in soft materials has enabled manufacturers to use lighter metals and plastics in various products and thus much reduce the weight of the entire assembly. It is also possible, in original design, to specify a shorter fastener or one of smaller diameter or both because of the greater thread strength of the insert.

Vectron, Inc. of Massachusetts, uses inserts in the aluminum body of their aerial camera for thread strength. In addition, the dimensions of the boss or flange of the outer housing is reduced below that ordinarily required in aluminum.

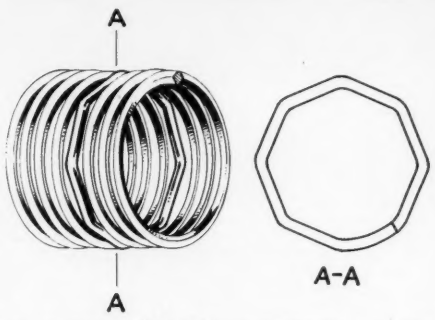
The edge distance or metal thickness is usually one-half the nominal diameter of the screw. For the ¼ in. screw used in the outer housing of the Vectron camera, the edge distance ordinarily would be .125 inches. Actually, the edge distance is only .092 in. which is the difference between radii of tapped hole and boss. The major diameter of the threads tapped for the insert is .316 in. The diameter of the boss is ½ in.

Rockwell Mfg. Co. were able to reduce the weight of a gas meter made at from 504 lb to 176 lb by substituting aluminum for cast iron. Thread strength was achieved by installing 4-in. inserts of the pipe thread series in the main inlet and outlet orifices which receive steel pipe to connect the meter into the gas line. Tests made by Rockwell show that the inserts provide a gas-tight seal with the pipe at pressures exceeding normal without sealing compounds. Smaller inserts (⅜ in. NC) are installed in the cover to secure the index plate.

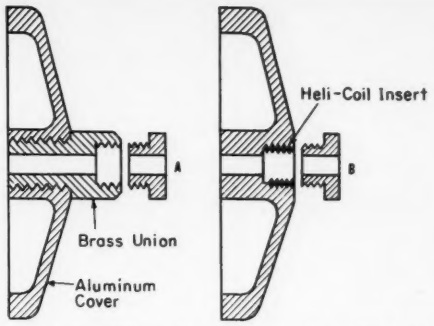
Light-weight synthetics have replaced metal in the design of many jigs and fixtures. Masonite templates have replaced steel for punching operations at Ingersoll-Rand Co. Strong, permanent threads in Masonite (to receive the steel screws which secure the punches in position) are obtained by wire thread inserts.

The total cost of templates including materials, inserts and labor has decreased from $200 to $80 each. In addition, the weight of the Masonite template is only one sixth that of steel. The Masonite templates can be handled manually without a hoist.

The Masonite templates are made of three ¼-in.



One or two middle coils approximate a polygon.



New design (B) replaces brass union with insert.

slabs glued together for stiffness. The holes for the wire thread inserts are drilled, rough tapped and finish tapped. The inserts are turned into the tapped threads with an inserting tool. The punch is placed in position and bolted into the threads provided by the insert.

Taktronix, Inc. of Oregon, recently designed a probe tip that incorporates several unique features of assembly as well as design. A nylon body is used for the probe tip because of its insulation properties, toughness and light weight. However, the tip must be screwed on to the probe and several tips might be used interchangeably with one probe. The problems of obtaining thread strength to permit tight electrical contact and resisting thread wear in relatively soft nylon were solved by protecting the nylon threads with a wire thread insert.

Cylinder head costs lower

Wire thread inserts have enabled Benton and Stone of England, to reduce the cost and weight of their aluminum "Enot" air cylinder heads by discontinuing the use of an expensive brass union (see diagram).

Because of the pressures encountered and the possibility of failure of threads tapped in aluminum, the original design specified that a brass union be screwed into coarse threads in the head. The union was tapped with a ¾-24 thread suitable for a ½ in. solderless joint to receive the outlet connection.

Pressure and wear tests conducted by the British insert manufacturer, Armstrong Patents Co., proved that the inserts would equal or surpass the performance of the brass connection.

Standard wire thread inserts are made of AMS 7245B stainless steel and AMS 7247B phosphor bronze. The bronze inserts are used to provide electrical contact in various types of boss materials. Precision-manufactured to provide internal nominal size threads, the inserts can be used interchangeably to provide any thread fit—Classes 3, 3B, 2 or 2B.

They are available in the following standard sizes and thread classifications: (a) 4-40 to 1½-6 sizes in National and Unified Coarse Thread Series; (b) 6-40 to 1½-12 in the National and Unified Fine Thread Series; (c) 10-1.0 mm to ⅞-18 in the automotive spark plug with a ¾-24 thread suitable for a ½ in solderless joint series; (d) 14-1.25 mm to 18-1.5 mm to 18-1.5 mm in the aviation spark plug series and (e) ⅛-27 to 1-11½ in the pipe thread series. Groups (a) and (b) are supplied in standard 1, 1½, 2, 2½ and 3-diameter lengths. Military standards have been issued for groups (a) and (b); groups (c), (d) and (e) conform to military requirements. Non-standard lengths and sizes can be supplied for special applications.

The recently developed screw-lock mid-grip insert has all the qualities of the standard wire thread insert and locks the engaging screw in place positively without the need for locknuts or locking wires.

The mid-grip insert exerts a strong locking effect on a screw fastener because one or two coils in the middle of the insert approximate a polygon instead of being perfectly round (see diagram). As the screw passes through this area, the gripping coils are forced to assume a circular shape. The chords of the "circle" press on the screw, giving the locking effect, which is not diminished through many cycles of dis-assembly. The locked screw may be freed by applying breakaway torque approximately the same as used in the original assembly. It is not necessary to seat the gripping coils with a special tool.

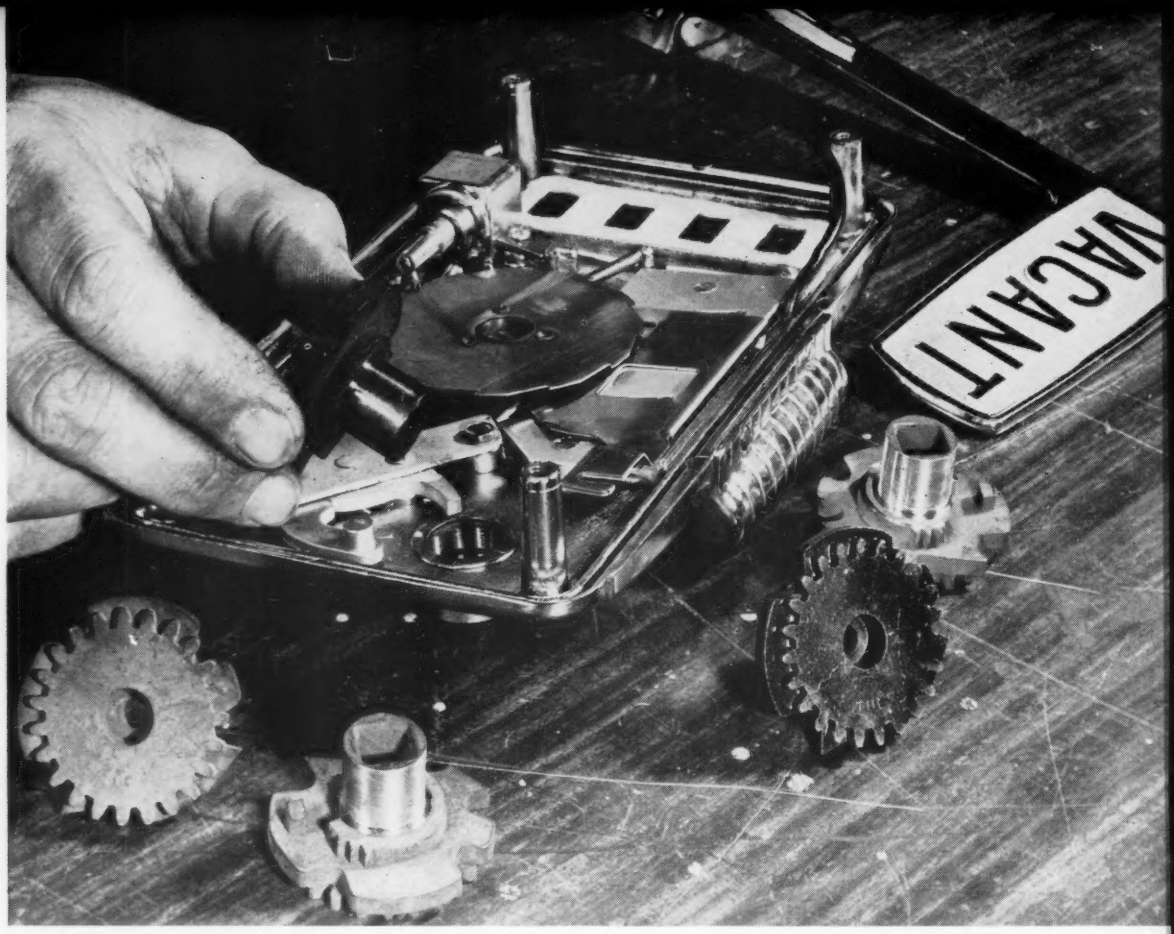
Because screws in mid-grip inserts need not carry locknuts, they may be shortened correspondingly. Reduction of screw length makes it possible to cut the weight and cost of an assembly.

The installation of standard wire thread inserts is quite simple, requiring only drilling and tapping to prepare the hole to receive the insert. The class of fit is determined by the tolerance to which the hole is tapped. Taps, gauges, and inserting tools are supplied by the insert manufacturer and the assembly can be accomplished manually or with power tools.

Both air and electrical power tools can be adapted to install inserts on a production basis. Tools installing as many as six inserts at the same time are in use. The insert manufacturer will assist users in the development of tools, jibs and fixtures required to install the inserts to meet special production requirements.

Drilling and tapping procedures follow standard shop practice. The inserting tool prewinds the insert and screws it into the specially tapped hole by applying torque to a diametral tang. If removal of the tang is required after installation, as in through holes or spark plug applications, the tang breaks off cleanly at a notch and is easily removed from the assembly.

With the development of the new Pip insert it is no longer necessary to tap internal threads in a hole to receive a threaded screw or bolt. The Pip push insert is pushed into a straight-sided, plain hole to provide strong, wear-resistant female threads in non-structural parts at a cost of less than one cent per hole. The hole can be drilled, molded or die cast. **(Cont. on page 92)**



A taxi meter is a difficult casting with lobes, teeth, ratchets and cams. Only beryllium copper could do it.

Now use beryllium copper for castings

Because it is easily handled and strong, here is a good casting material

Advantages of Cast Beryllium Copper

The following will give the design engineer an idea of the unusual combination of characteristics and advantages of finished cast parts in beryllium copper:

HIGH STRENGTH AND WEAR RESISTANCE
ANTI-CORROSIVE PROPERTIES
DUCTILITY AND IMPACT STRENGTH RETAINED DOWN TO —300F
NON-MAGNETIC AND ANTI-SPARKING PROPERTIES
LOW COST OF COMPLICATED PARTS AND EASILY CAST
HIGH THERMAL AND ELECTRICAL CONDUCTIVITY
INEXPENSIVE REPLACEMENT DIRECT FROM PATTERN

By Peter G. Kingsmill, P.ENG. PECKOVER'S LTD.

The advantages of beryllium copper wrought alloy components are already well known to many industries, but it is only recently that engineers have begun to realize the fantastic possibilities of beryllium copper as a casting. Its fluidity at casting temperatures as low as 1850 F make it one of the easiest and soundest materials to handle. Its ultimate tensile strength, in the region of 170,000 psi, puts beryllium copper in the class of high-grade steel.

Until now, the advantages of beryllium copper castings have been exploited only by injection molders. The accurate reproduction of intricate detail, with low finishing costs, put the material in a very favorable position in this field.

Particularly is this so for the injection molding of nylon parts, since the high thermal conductivity speeds the thermal cycle. Molders report production increases from 10 to 40%, depending on the part.

High strength alloys are cast at temperatures from

1850 to 2050 F. Beryllium, which incidentally is used as an additive to improve flow in other alloys such as chrome copper, has excellent flow properties and gives sound castings with a smooth surface finish, particularly suitable for centrifugal pressure castings.

Low melt temperatures, compared with ferrous alloys of comparable strength, greatly simplify casting techniques. American casting firms report a 50% lower rejection rate with beryllium copper.

Standard techniques apply for sand castings, permanent mold, centrifugal, pressure, plaster mold, investment and shell mold techniques.

The use of beryllium copper for forming and drawing dies comes to the fore where production time and tool cost must be reduced. Of special interest are the anti-galling characteristics.

Beryllium copper cast dies in steel forming operations were first used to make stainless steel parts, because attempts to deep-draw some of the more refractory grades of stainless steel had led to considerable difficulty, due to pick up on the cup radius.

The first dies were machined from an air-hardening tool steel, heat-treated to Rockwell C 60-62. The die was then polished to a mirror finish and during the operation special lubricants were used. In spite of such extreme care, it was still necessary to polish each cup.

Machining work made easier

In an effort to solve this problem of high die cost and poor production results, a draw die was cast from beryllium copper. The die was solution annealed and finish machined, the hardness of the die in that state being Rockwell B 60 - 75. Compared with the tool steel previously used, the finish machining operation was considerably easier.

The die was then heat-treated in a low temperature furnace (650 F) to give a hardness of Rockwell C42-45. The last operation was a high finish polish, using crocus cloth in the drawing direction.

And the results. Due to the wear resistance and anti-galling properties, it was not necessary to polish the finished part or to carry out intermediate annealing operations. An added advantage was the greater consistency of wall thickness in the finished part.

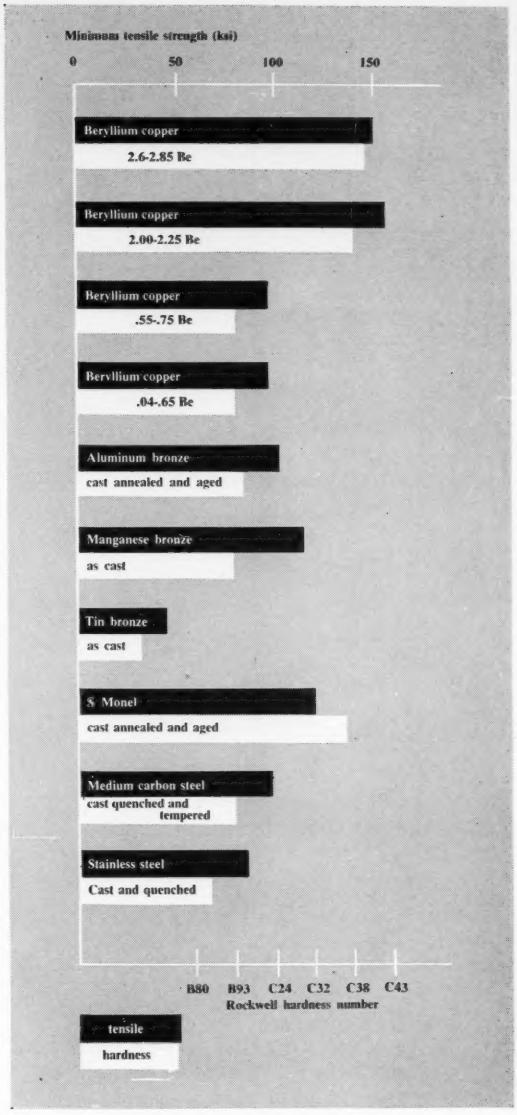
With one die it was possible to handle sheet from 0.032 to 0.093 in., simply by changing the steel punch. The dies in this form are used in one piece or as an insert in a steel die.

The success of beryllium copper dies in this application stimulated additional forming applications for cold rolled steel sheet. The fact that it can be cast and finish ground in a matter of hours greatly reduces lead time on formed and drawn parts.

In a compressor shell produced by Frigidaire of Dayton, Ohio, one beryllium copper die formed 35,000 to 40,000 of these parts from 0.165 in. cold rolled steel. Here the die gives the first draw to 2½ in. deep by 9¼ in. diameter. The anti-galling properties of the die greatly reduced the lubricating problem and in this instance a swab of soapy water was all that was needed.

Another feature for consideration is the storage problem. If the part is to be run again in the near future, the beryllium die can be stored without fear of corrosion.

In the event of breakage, the replacement problem is very simple. The material may be remelted, built up with a small amount of master alloy and cast again. It should be noted, however, that a remelt loses approximately 0.1% beryllium, a thing to bear in mind.



An at-a-glance comparison

How does beryllium copper compare with other metals? The chart shows — black for tensile, white hardness.

As beryllium copper alloys are precipitation hardened, the physical properties of cast parts are very close to those of wrought products. Tensile strengths up to 170,000 psi with a hardness of Rockwell C42 can be obtained. With modern casting techniques these physicals will be found throughout the part.

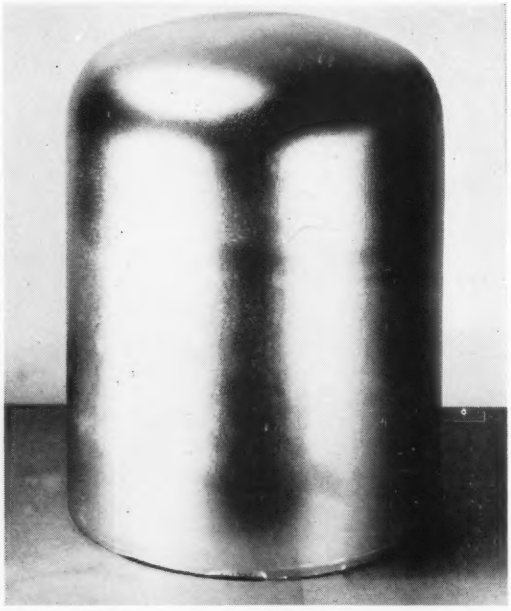
There are four principal alloys available the chemical difference between which is chiefly the percentage of beryllium. Table 1 shows the principal variation in characteristics.

The 0.40 to 0.65 alloy (Berylco 50 CR) is a resistance welding electrode and fixture alloy (RWMA Class 3) used in dies, jaws and electrode holders.

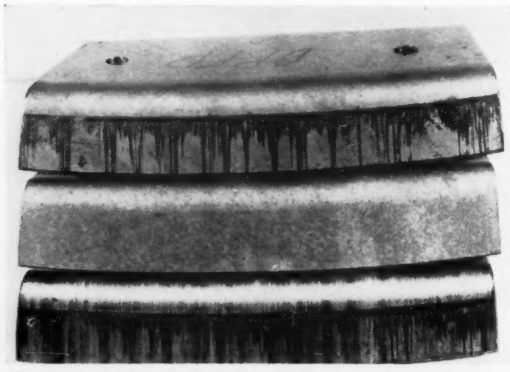
The 0.55 to 0.75 (Berylco 10 CR) alloy is used principally for high conductivity.

Another feature of this alloy is its ability to resist

Removing an aluminum forging from a die made of cast beryllium copper. Long runs come from this material.



One of 35,000 compressor shells drawn on a beryllium copper die and made of 0.165 in. cold, rolled steel.



Formed titanium sheet. Centre part was formed from a cast beryllium die — note the absence of galling lines.

softening at temperatures up to (and above) 800 F.

The 2.0 to 2.25 alloy (Berylco 20 CR) is most widely used of the high strength alloys. In addition to its high strength characteristics, it features high wear and corrosion resistance, is non-magnetic, and has non-sparking qualities.

The highest beryllium alloy 2.60 to 2.85 (Berylco 275 CR), though sacrificing something in strength, has excellent as cast surface finish. Its ability accurately to reproduce intricate detail makes it particularly suitable for pressure-casting plastic molds and zinc die-casting cavities.

One of the reasons for the high cost of aircraft is the excessively high tooling costs with only short runs to amortize the dies. The aircraft industry has done a tremendous job in pioneering new production methods and after a great deal of research, beryllium copper cast dies emerged as the answer for long-run aluminum and magnesium forgings. It is also being used for short-run steel forgings.

One of the most interesting uses has been the forging of large parts in hydraulic pressses with a dwelt time cycle of 15 seconds or more. Although more expensive than other materials ($1.85 per lb.) it may be remelted and used again. The scrap value (approximately 65c per lb.) will always be high, thus reducing the final cost accordingly.

A jumbo-size die being made

To date 1,200-lb. dies have been produced and a 3,500-lb. die is in the making at the time of writing.

Where high production requires several dies, these may be cast from the same pattern. The inevitable design change can also be handled faster and cheaper.

Actually the savings of cast forging dies is obvious to all. The material was the problem and it looks as if beryllium copper is the answer.

Cases are on record of successful forging applications with Aluminum 75S and 14S, Magnesium AZ80A and Steel 1027, 1090, 4340 and 8615.

Runs of 17,000 parts with steel 1027 and 11,100 parts of steel 8615 indicate the possibilities.

Although figures are not complete enough to form concrete conclusions they do predict an interesting future.

An increased demand for titanium sheet has magnified many basic problems in the drawing and forming of metal. Where there is a sliding, wiping or drawing action, beryllium copper dies have a definite advantage over steel. Illustrated are three titanium parts formed from sheet on different dies. Printer's ink has been painted on each part and then wiped off to leave galling lines. The centre piece, formed with a beryllium die, shows no signs of galling.

Pure titanium is formed at 300 to 600 F and alloy AMS 4908 at 900 to 1,000 F. As the dies must be heated, beryllium copper has an added advantage. Instead of machining holes for heating units, stainless steel tubes are cast right into the die. Calrod elements are then inserted. The high thermal conductivity reduces the power required to heat the die by 50 to 60%. Although this application is rather limited, it does show the versatility of beryllium copper cast dies.

CHARACTERISTICS OF FOUR BERYLLIUM COPPER ALLOYS
PROPERTIES ARE ALL FOR CAST, ANNEALED AND HARDENED

ALLOY				
Beryllium %	2.60-2.85	2.00-2.25	0.55-0.75	0.40-0.65
Cobalt %	0.35-0.65	0.35-0.65	2.35-2.70	1.40-1.70
Silver %				1.00-1.20
Trade Name	BERYCLO 275CR	BERYLCO 20CR	BERYLCO 10CR	BERYLCO 50 CR
Tensile Strength (psi)	150-165,000	155-170,000	95,000 min.	95,000 min.
Yield Strength (0.2% offset) (psi)	110-130,000	115-155,000	55,000 min.	55,000 min.
Rockwell Hardness	C42-46	C38-45	B 92 (min.)	B 92 (min.)
Compression Strength (psi)	190-200,000	—	—	—
Minimum Electrical Conductivity	15	18	45	45
Pouring Temperature	1,850-1,950 F	1,900-2,100 F	2,050-2,200 F	2,050-2,200 F
Shrinkage—in/ft.	3/16	3/16	3/16	3/16
Annealing temp. for "As Cast"—3 hours	1,475-1,500 F	1,475-1,500 F	1,675-1,700 F	1,675-1,700 F
Hardening Temp. 3 hours	650 F	650 F	900 F	900 F
Maximum Decrease in length —	2%	2%	—	—

Here is a performance summary

How do the four beryllium copper alloys compare with each other? The answers are given in the table above.

Some time ago an American zinc die-casting firm decided that if the plastic molders could make large cost savings with beryllium copper cavities, they too could enjoy such economies. At the moment there are several commercial die-casting plants using beryllium copper cavities for high production quantities. Although the application is relatively new, there have been several production runs with excellent results.

The greatest success has been obtained by having the cavities hardened and chrome-plated to avoid fusion between the zinc and the beryllium copper. One die-caster is up to 300,000 castings with no appreciable wear on the die. They estimate that with normal care these cavities should pass the million-shot mark in good condition.

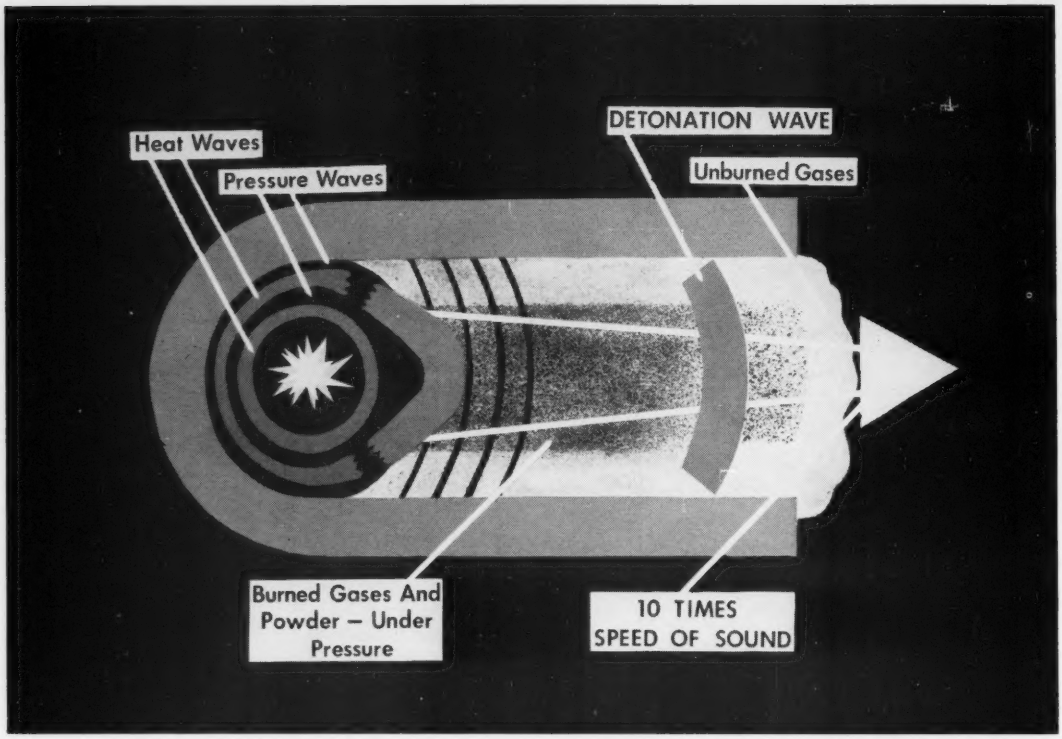
Here again we get back to the excellent castability of beryllium copper. The fact that they cast very close to the desired shape, with little finish machining time, allows savings in cost and lead time. Also, the beryllium copper hardens completely throughout, as compared to the case-hardening technique which is all that can be used on soft hobbing iron. To date there has been no trouble reported with soldering, heat checking or erosion.

Costwise, beryllium copper cavities compare with hobbed steel cavities. Their economy becomes apparent at the machined stage before fitting into the die. There is a reduction in machine hours and bench time in the final preparation of the cavities for the die shoe. Of course, the maintenance and storage of beryllium copper requires no special consideration as the alloy is not corrosive.

It becomes readily apparent that if beryllium copper castings can handle such rugged applications as forging dies, there is an unlimited field for cast parts.

Anti-galling characteristics and compression strengths of 200,000 psi make the material ideal for bearings. Castability, with tensiles of 170,000 psi and throughout hardness of C42-46, make it ideal for complicated gears.

The industrial world has had its historical thinking thoroughly jarred by beryllium copper. The idea that a copper alloy could have the strength of steel is a fact that is difficult to believe, but true nonetheless. ★



Heat-and-pressure wave rips through gas powder mixture, bursts out of barrel and hurls tungsten at workpiece.

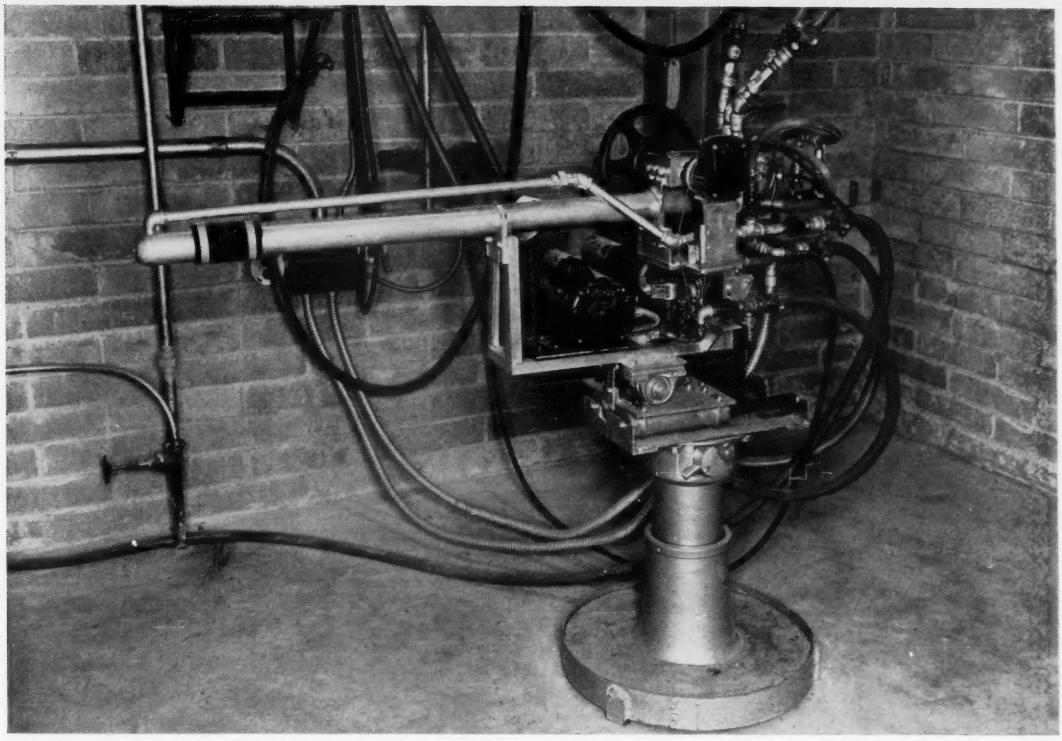
Shop method

Overcome wear with new flame-plating

Explode tungsten particles onto metal parts to make them tough and durable

Brief facts about flame plated tungsten coating

Composition	92% tungsten carbide, 8% cobalt
Hardness	1350 Vickers (300 gram load) 89.3 Rockwell "A" (Theoretical)
Coating thickness	Maximum — 0.010 in. Minimum — 0.002 in.
Surface finish (as coated)	125 microin. rms
Surface (ground and lapped)	0.5 microin. rms
Base materials	Steels, cast iron, aluminum, copper, brass, titanium, bronze, magnesium, nickel, molybdenum
Temperature of base piece during application of coating	Never exceeds 400 deg F (usually less)



The flame-plating gun. Loaded with oxygen, acetylene and tungsten, it is aimed and fired by remote control.

By F. L. Neuman LINDE AIR PRODUCTS CO.

Flame-Plating is a modern and unique method for depositing a tungsten carbide coating on metal parts to improve their wear resistance. This new process was developed in the U. S. as part of a broad project to discover what constructive use could be made of detonations in gas mixtures containing acetylene.

The process has become a valuable tool in solving many of the wear problems in industry. Spindles, bushings, seals, gauges, mandrels, dies, and core rods are only a few of many current applications where flame-plated coatings have greatly improved the wear resistance of parts and tools.

Although many uses of flame-plating are currently thought of as standard production items, a vast potential market is yet to be discovered. As more and more design engineers become aware of the advantages in using flame-plating, it will perhaps become a standard engineering practice.

So far, tungsten carbide is the only material which is being commercially flame-plated. But several other coating materials are in the development stage.

Particles of tungsten carbide are fed into the chamber of a specially constructed gun, and are suspended in a mixture of oxygen and acetylene. When this mixture is ignited, a detonation takes place. The detonation wave travels at 10 times the speed of sound through the barrel, heating the particles to plasticity, and imparting a supersonic velocity to them. The particles are hurled out of the barrel and embed themselves in the surface of the workpiece where a microscopic welding action takes place producing a tenacious bond at the interface. Although the temperature of the gases inside the gun barrel reach 6,000 deg F, the temperature of the part being plated never exceeds 400 deg F. Thus, there is little chance that the product will warp or that the metallurgical properties will be changed. Successive detonations build up the coating material to the thickness wanted.

After flame-plating, the surface of the workpiece looks (and feels) like fine emery paper. The part may be used in this condition or finished to various degrees of smoothness by standard carbide or diamond finishing methods.

The coating consists of layers or laminae. Even though there is a distinct boundary between the coating and the base metal, there is no visible oxide layer. The indications are that the bond between the coating and the base is more than mechanical. The fact that the coating does not mix with the base metal is important because the properties of both the base metal and the coating are retained.

Flame-plating is at its best where wear is extremely critical—when the functioning of machinery depends on precision. Extensive tests indicate that the flame-plated coating is unmatched in its resistance to frictional and abrasive wear. Flame-plated parts have shown wear resistance superior to solid sintered tungsten carbide, hard chrome plating and tool steels. Besides this, the flame-plated parts have a greater resistance to mechanical shock than solid sintered tungsten carbide. Thermal shock resistance also is excellent —tests have shown that they will withstand repeated rapid cycles of heating and cooling between 1350 deg and 120 deg F without failure.

Base metal can be steel, cast iron, aluminum, cop-

Flame plating *(continued)*

per, brass, bronze, molybdenum, nickel, magnesium, titanium and their alloys. This ability to use a variety of base metals opens a wide field to the design engineer. For example, a combination of light weight, low moment of inertia and high wear resistance can be obtained by coating aluminum, magnesium or titanium. Because base metal temperature seldom exceeds 400 deg F, changes in the mechanical properties of the metal and distortion of the part are negligible.

Flame-plating is not recommended for metal-cutting edges because too little material is present to allow resharpening. It is not suitable for use on parts, such as power shovel teeth or tractor treads, where literally inches of wear are permissible.

The shape of a part has to be considered before the process is used. As the coating is formed by particles striking the surface, only those areas which permit free access will be coated evenly. Narrow holes, blind cavities, deep grooves, and sharp corners give unsatisfactory service. Also, the coatings are not generally considered corrosion resistant.

To arrive at the true value and cost of flame-plating, the outlay in dollars must be balanced against the savings realized from increased service life, increased production with fewer rejects, decreased down-time of machines for maintenance and replacement of parts, and the possibility of a decrease in lubrication problems. Any one or a combination of these advantages can not only offset the flame-plating expense, but, in many cases, can actually reduce the cost of the part.

Many flame-plated parts require only an as-coated surface to increase their service life many times. The surface finish in this condition has an over-all average smoothness of 120-130 microinch rms—smoother than fine emery paper.

Other flame-plated parts require very smooth surfaces. For these applications, the coating is ground and, in some cases, lapped to a 0.5 microinch rms finish.

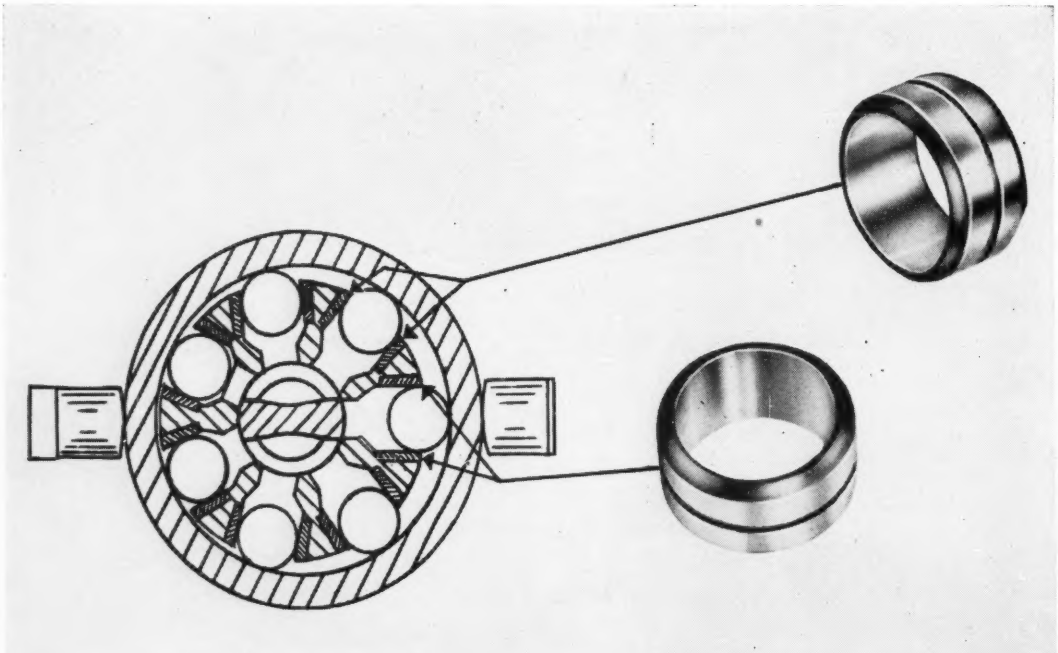
Here are some "as-coated" examples which show what the process offers industry:

Slicing Rubber. A disc-like skiving knife is used in the rubber products industry to slice rubber into strips of designated widths. The high-alloy steel blades used by one company wore excessively and had to be removed from the machine and resharpened after each shift. By flame-plating these knives, their service life was increased 15 times. The tungsten carbide was flame-plated on the flat unbeveled side of the knife. This achieved a self-sharpening effect as the softer, steel base wore more rapidly than the coating, thereby presenting always a sharp edge to the rubber being cut.

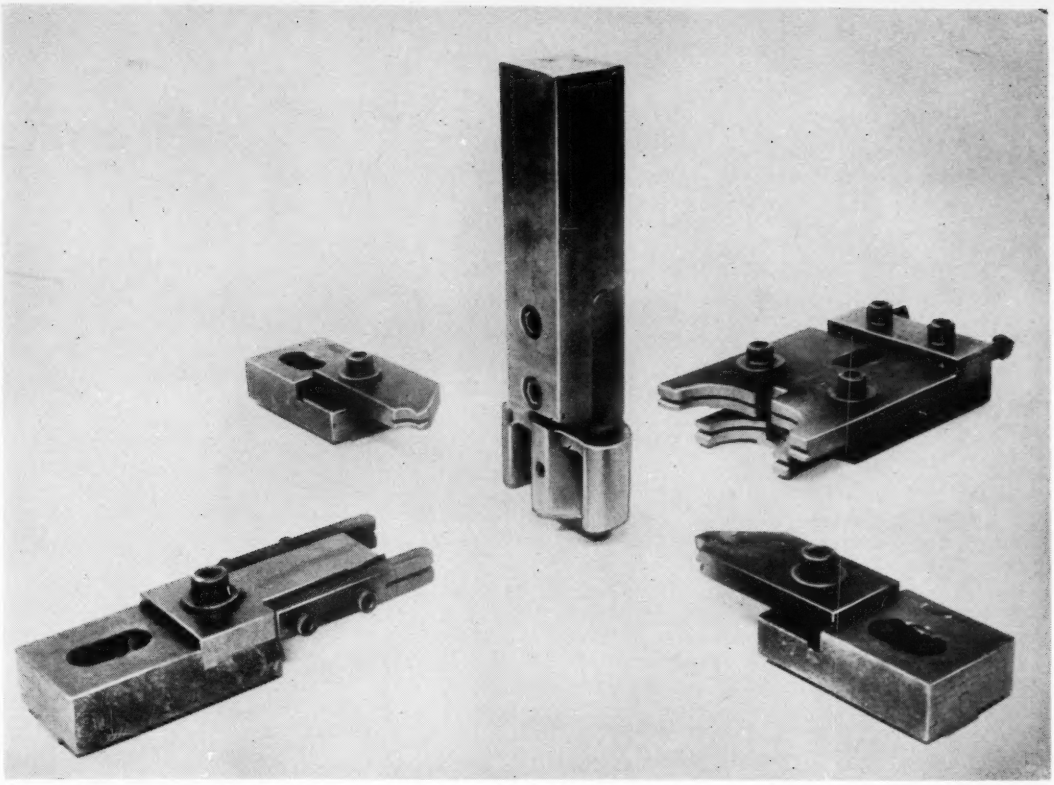
Dicing of Plastics. For certain purposes, plastic sheeting is cut into tiny cubes. One manufacturer used serrated knives for this use but found they became dull quickly. He solved this problem by flame-plating the knives and now three times as much plastic material can be processed before the first resharpening is necessary.

Wire Forming. One manufacturer has found that by flame-plating wire forming mandrels he has increased production of wire springs as much as 74%. The flame-plated tools were reported to last 10 times longer in operation than the previously used hardened tool steel parts. In this particular case, the flame-plated coating on the vertical mandrel was brush finished (to 40-50 microinch rms) to provide a smooth surface.

Drilling. Excessive down time of machines used to drill holes in acoustical tile was a bottleneck to one tile



Ball pistons in this long-life hydraulic pump ride in flame-plated bushings. The tungsten coatings make them very resistant to wear — and also have the same coefficient of thermal expansion as the steel balls and block.



Flame plating protects these wire forming mandrels where they contact the spring wire stock. One manufacturer reports that tools protected this way last 10 times longer in service and that production has increased by 74%.

Quick wearing parts can have much longer lives if they are flame plated

manufacturer. This problem was solved when the outside surface of the tubular drills was flame-plated with 0.002 in. of tungsten carbide. This plated drills made more than 50 times the number of holes that could be produced by the unplated drills.

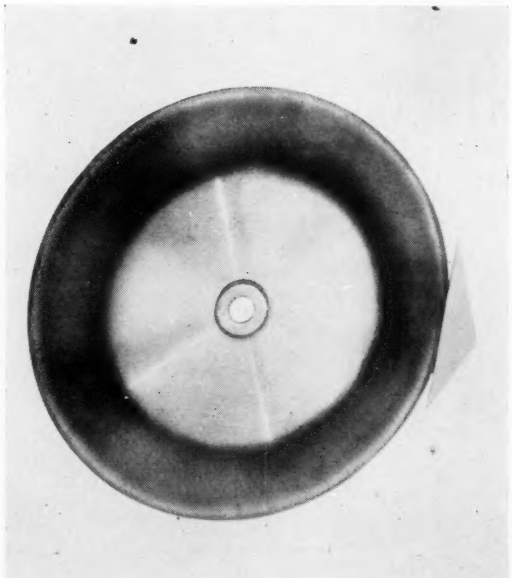
Feeding and Gripping. In one textile mill, the service life of sewing machine feed dogs (the movable, serrated part which pushes the cloth through the sewing machine) has been increased more than six times that of unplated feed dogs by flame-plating the wearing surface with a 0.002-in. coating.

In a similar job, the flame-plating of gripper dogs used in metal strapping tools, resulted in a sharper gripping power and service life of up to five times that of the unplated parts.

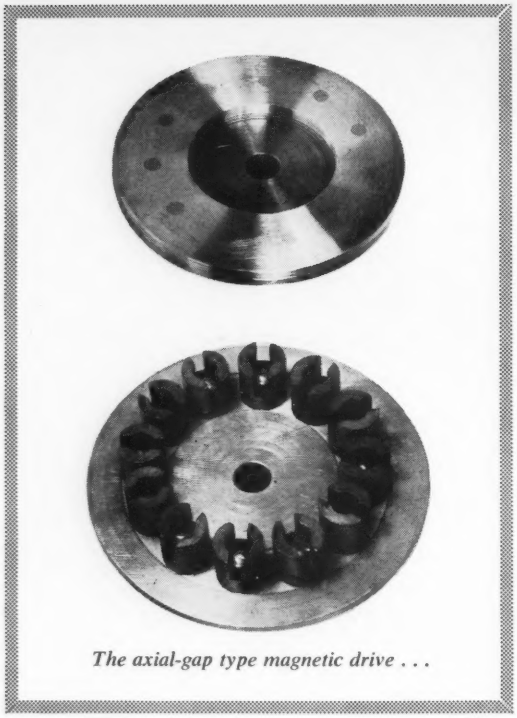
Paper Box Blanking. In a rotary box blanking machine, one paperbox maker found the anvil block (mounted on a roll opposing the cutter and scorer blades) was subjected to severe wear. The addition of a flame-plated coating to this part increased its service life to an average of four times longer than unplated parts, reducing down-time costs accordingly.

In this case, the flame-plated anvils are removed from service before the base metal is worn; hence the blocks can be electrolytically stripped and recoated. By doing so, the base metal remains undamaged and expensive part replacement is avoided.

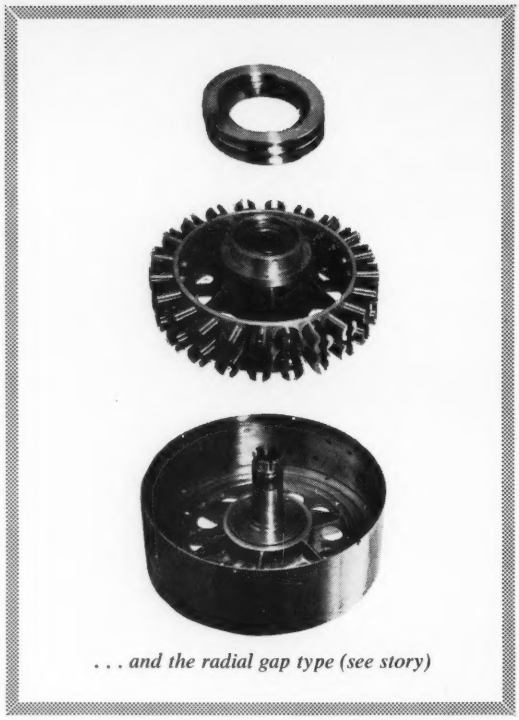
There are also many **(Continued on page 66)**



Rubber skiving knives had to be resharpened following each shift. Flame plate lengthened life by 15 times.



The axial-gap type magnetic drive . . .



. . . and the radial gap type (see story)

A new type of drive comes from Canada

This permanent magnet, eddy current drive will handle power up to 100 hp

By John Nichol TORMAG TRANSMISSIONS LTD.

This is a story of Canadian achievement — of a torque transmission which has been seven years in the making. Two men have been specially prominent in the work throughout. They are Maj.-Gen. H. F. G. Letson, president of Tormag Transmissions Ltd., and Dr. George Volkoff of the University of British Columbia who between them have found new answers to some old problems. They have perfected a new flexible, slip-type drive which will transmit power from motors in the fractional hp to 100 hp range.

It is a permanent magnet, eddy current drive (designed as a self-contained unit) which needs no electrical excitation.

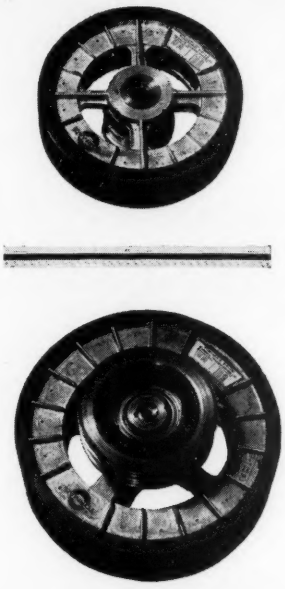
In 1947, a group of engineers working in Vancouver were searching for some way to get rid of troublesome shaft seals on agitator shafts in milk tanks. They were looking for an efficient way to transmit torque through a stainless steel wall. In the end their research was successful — and one result was a whole series of new drives now developed and patented.

The drives offer the design engineer a combination of desirable characteristics not previously available. Driving through an air-gap is a big one; there is never any mechanical contact between driving and driven parts. This gives smooth pickup of heavy, unbalanced or fluctuating loads, the elimination of shock and vibration and permits accurately controllable torque output characteristics. Motor overload protection is another basic feature. The units will run indefinitely, with the output shaft stalled, without damage to the Tormag unit or the motor. Efficiencies up to 95% at rated hp are obtained. In addition to this, speed reduction and speed increase can be obtained without the use of mechanical connection.

Most designs are fully reversible under full load. They are unaffected by exterior temperature within the range in which ball bearings are practical. And, since the drives make use of magnetic flux, a stainless steel diaphragm can be introduced between the driving and driven components, so permitting the design of pumps and agitators without shaft seals.

Eddy currents or "Foucault" currents are those currents induced in masses of metal whenever the metal is moved in a magnetic field, or when a field or flux moves through the metal. This is a well known phenomenon which has been made use of for many years in a wide variety of devices. This principle forms the basis of the electric squirrel-cage induction motor; and in recent years its most direct application has been in the field of electromagnetic drives and brakes.

The magnetic field may have its source in the windings of an electromagnet or in a permanent magnet, but until recently the flux-to-weight ratio of permanent magnets was such that permanent magnets



Here are two sizes of the compact unit.

Below, typical couplings (cylindrical drive) input 1,750 rpm

hp	1	2	3	5	7½	10	
operating torque T_o	3.0	6	9	15	22.5	30	(ft-lb)
maximum torque Tmax	6.25	12.5	16.6	24.2	31.5	43.0	(ft-lb)
stalled torque T_s	5.05	10.10	12.9	17.7	21.6	27.8	(ft-lb)
over-all diameter	9¾	9¾	10¾	12¼	13¾	15¾	(in.)
length	4	5	5½	7	7½	8	(in.)

could be used as a flux source only in very special situations or where torques were very small. The development of Alnico permanent magnets by the General Electric Co. has changed this picture and now permanent magnet, eddy-current drives are more efficient, smaller in size, and of higher horsepower capacity than was ever thought possible.

The Tormag drives all make use of two basic components (see pictures). There is:

The magnetic rotor. This is a disc upon which are fixed Alnico V permanent magnets.

The bimetallic rotor. This consists of a copper faced mild steel plate perforated with steel rivets or inserts.

The rotors are mounted face-to-face with an axial air-gap between them. If either of the rotors is driven, eddy-currents are generated in the bimetallic rotor and a torque is induced in the other component. The driving and driven rotors are never in contact: there is always an air-gap between them.

In going beyond this simple plate coupling, the designer can make use of different types of magnetic and bimetallic component to obtain the performance characteristics he requires. In the cylindrical type of drive (see pictures) the component rotors are built as cylinders and the torque is transmitted across a radial air-gap, instead of an axial air-gap as in the case of the disc. Then again, mounting the rotors on different centre lines produces speedup or speed reduction with a corresponding conversion of torque.

Variable speed designs, using squirrel-cage motors as a power source, are developed two main ways with Tormag component.

1 Variable speed with variable torque. By making it possible to move one rotor relative to the other, a varying flux density in the bimetallic rotor is produced. This results in changes in output speed of the unit. In this case output torque decreases when speed decreases — and vice versa.

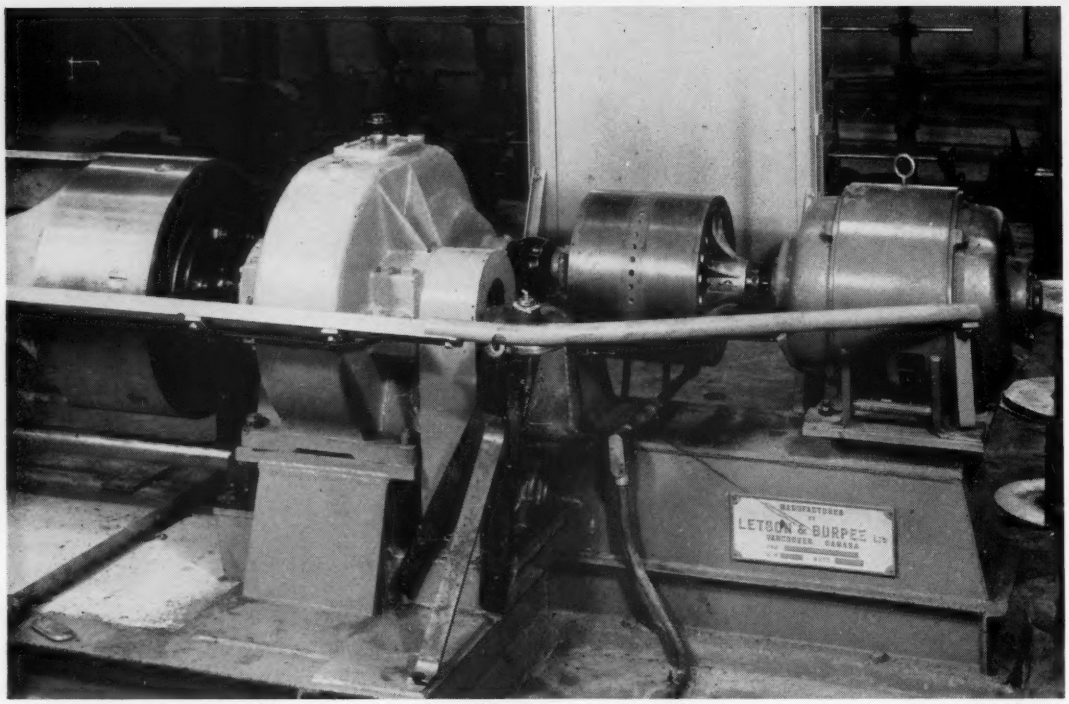
2 Variable speed with constant torque. Constant torque output with a speed variation of up to 20-1 is available through another adaptation. The output of one fixed air-gap unit is governed by a second unit which has a variable air-gap. The performance curves of both units are selected so that a constant output torque is found over the desired speed range. There is no electrical excitation — and no frictional components. The speed change is brought about by a mechanical movement of one rotor.

In designing one of these torque transmission drives, the engineer asks himself a number of questions. How much torque is required? And at what speeds? Is variable speed required and, if so, of what type and over what range? Is motor protection of prime importance? When the answers to these and other performance questions have been decided, a torque slip curve is chosen which will give the required characteristic. Then the design is prepared by making a correct selection of these variable factors: Number and size of Alnico permanent magnets; air-gap; copper thickness; mild steel thickness; diameters (rim speed); number and location of rivets.

Torque slip curves of the types shown (see diagram) give the designer a choice of variables.

For example, a set of brakes was designed to control the fall of headgates on a hydro-electric development. A curve of type C was used because it gave increasing braking torque with increasing speed of fall — so giving the maximum control.

In another case, a unit giving 30 hp at 1,750 rpm was built as a helper drive to steam-driven dryer rolls in a pulp mill. The problem here — and it is a good example—was to exert a constant **(continued over page)**



A permanent magnet, eddy current drive in action. It is powering a Vancouver company's wire rope strander.

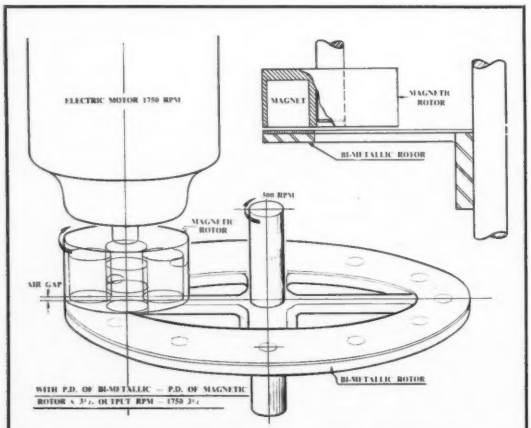
Tormag drives *(continued)*

helping torque without, on the one hand, overloading the motor or retarding the steam driven shaft on the other. This could have been accomplished electronically or by using complex hydraulics, but a Tormag unit was employed with a Type B constant torque curve. This unit delivers a pre-calculated torque, regardless of the load on the output side.

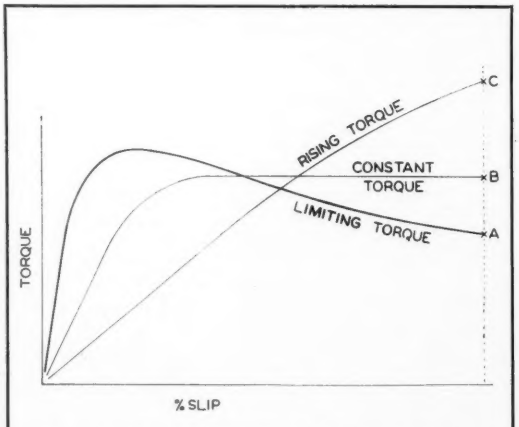
As a further example, a 30 hp, 1,750 rpm unit was designed for a wire rope strander. This application called for a method of picking up a high intertia load without overloading the motor during a prolonged acceleration time, while no buildup in torque could be tolerated in the stall. For this application a limiting torque curve of Type A was used.

Mechanical design consists of determining the method of power take-off; sheave, sprocket or direct-through drive, selection of bearings, shaft sizes, and so on. The Tormag units make use of accepted practice in mechanical design.

During the development of the drives, the problem of heat and its effects was one which demanded extended research. The problems arose in several different forms. Firstly, when, for instance, a Tormag coupling is driven by an electric motor and the output shaft is stalled, the full horsepower of the motor appears as heat. A charactertistic of the drives is that generated



How the Tormag drive works shown diagrammatically.



Torque and its relationship to slip—at a glance.

heat appears only in the bimetallic rotor and never in any other component. For this reason, the bimetallic rotor is always made the driving member so that it is always at motor speed and maximum cooling is obtained. Cooling is further improved because the bimetallic rotor is the outside member and so gets the maximum exposure to the air. The result of this construction is that, in full stall, the bimetallic rotor reaches a safe precalculated heat equilibrium point. The magnetic rotor and all other parts remain cool.

Secondly, the bimetallic rotor is so designed, and the rivets so placed, that the undesirable effects of differential thermal expansion, (between copper and mild steel) are eliminated.

Thirdly, heat presents a problem, because the electrical conductivity of metals decreases with increasing temperature. This means that, in the stall, when there is a resultant temperature rise in the bimetallic rotor, the unit is less receptive to the generation of eddy-currents and so could be expected to deliver less torque than when cold. By research into the design of the bimetallic flux path, a combination of copper, steel and rivets was chosen to eliminate this problem.

New development work in this field is being pushed ahead and new designs and applications are being brought out. Patents have been granted and new Canadian, American and foreign patents are pending at the present time. Designing for specific applications is carried out by Tormag and engineering advice is available from the company to any potential users. Dr. George Volkoff, F.R.S.C., M.B.E., one of Canada's leading scientists and Mr. Igor Zozulin, an engineer for the City of Belgrade before the war (now a Canadian citizen and registered professional engineer) have seen this project rise since 1947 from a simple idea for agitating milk to a versatile tool of industry. ★

Behind the Tormag lies a lot of theorizing . . . . .

Consider a metal plate located between two stationary bar magnets as shown in diagram 1. Now let the plate move to the right at speed V. Any segment, such as AA^1 or BB^1 of the moving plate, then cuts across the lines of magnetic flux and has an electromotive force set up in it directed from A toward A^1 (or from B toward B^1) of magnitude proportional to the rate of cutting the lines of force. This rate of cutting depends on the number of lines present and the speed (V) of the plate.

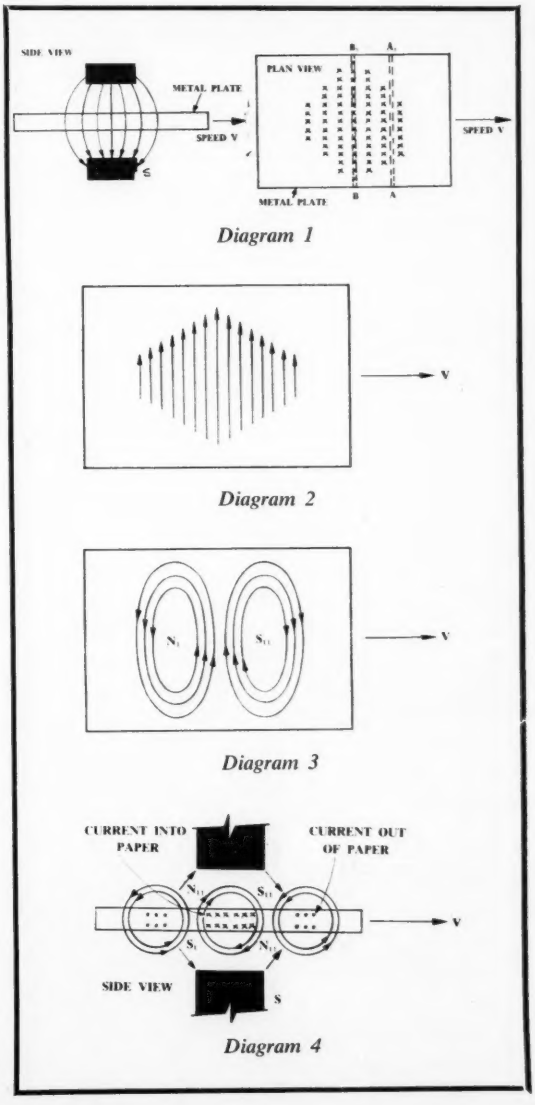
Since both AA^1 and BB^1 are moving with the same speed, but BB^1 lies in the stronger field, it will have a stronger electromotive force induced in it, so that schematically the electromotive forces induced in adjacent segments can be represented by arrows of varying length — see diagram 2.

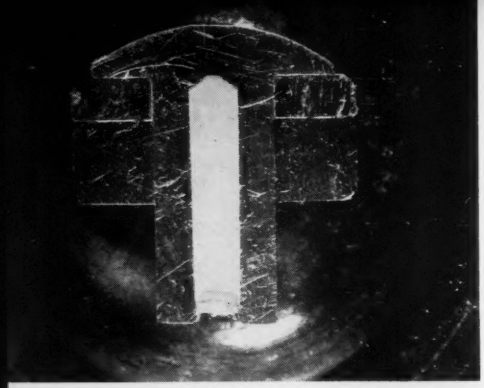
Such a distribution of electromotive force will give rise to eddy currents of the type schematically shown in diagram 3.

The current density produced will be the product of the electromotive force appearing in the plate and the electrical conductivity of the plate. The circulating eddy currents of diagram 3 will give rise to their own lines of magnetic flux shown schematically in diagram 4, which are equivalent to those of the induced magnetic poles N^1, S^1 and N^{11}, S^{11} in diagrams 3 and 4.

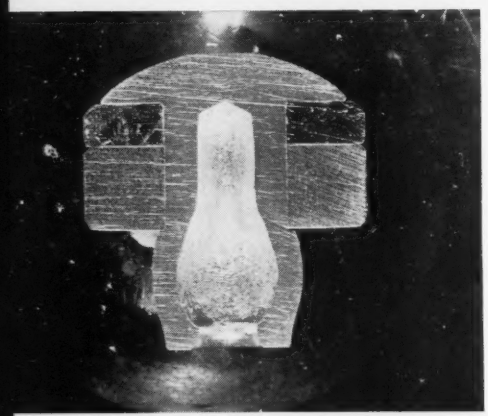
The strength of these induced magnetic fields depends on the density of the eddy currents. The stationary pole N is repelled by N^1 and attracted by S^{11}, while the stationary pole S is repelled by S^1 and attracted by N^{11}, as shown schematically by the arrows in diagram 4 which represent the forces acting on N and S. So the motion of the metal plate in the direction of the velocity vector V will produce a force on the stationary bar magnets in the same direction. With the assumption made so far there appears no net force acting on N and S perpendicular to the metal plate, as the perpendicular component of the repulsion of N by N^1 is the perpendicular component of the attraction of N by S^{11}.

If the metal plate were held stationary and the bar magnets were pulled to the right with speed V, then the direction of the electromotive force, the eddy currents and the polarity of the poles would **(cont. page 84)**

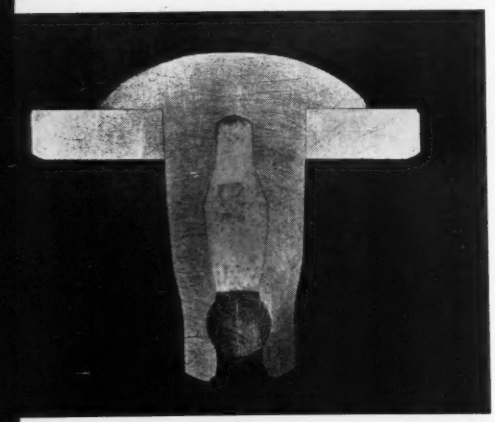




1 (a) Sectional view of a rivet inserted. Heat on its head will cause an explosion.

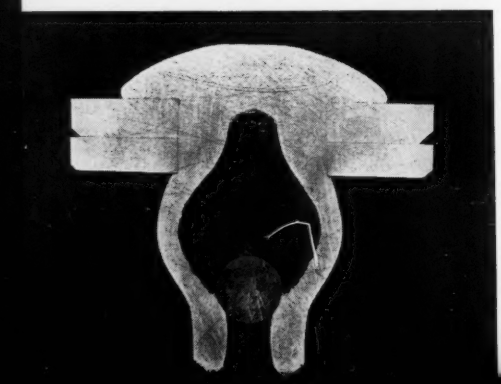


1 (b) After the inner charge has ignited the rivet expands and so grips like this.



2 (a) Explosive rivets can be noiseless, like this one — shown before being fired.

2 (b) The noiseless rivet expands in much the same way, has blast inhibiting shape.



Fixing method

Explosive rivets make the driven kind look out of date

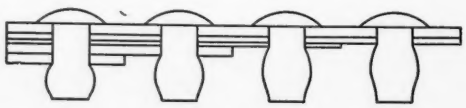
A tiny charge in the shank of the rivet explodes if the head is heated for just half a second — and the setting is made

What explosive rivets offer you

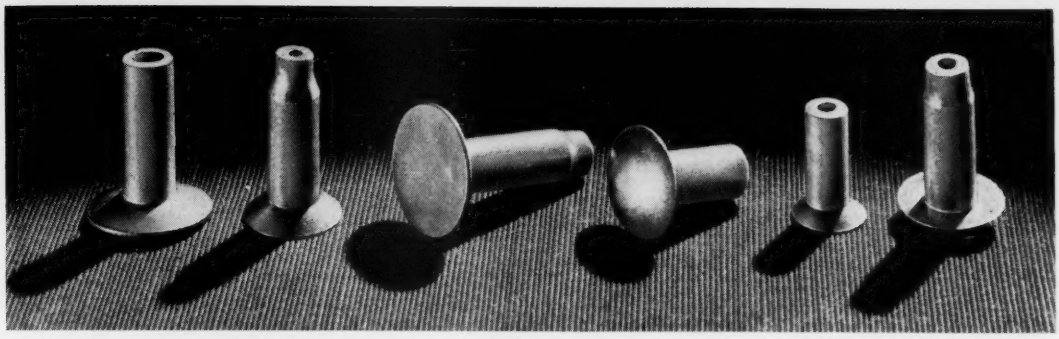
Du Pont Industrial Explosive Rivets are economical. They save time and labor on both primary and secondary fastening jobs, and have proved so effective in lowering installed fastener costs that in open work they have frequently replaced solid rivets, nuts and bolts, metal screws and other fasteners. To the design engineer, they offer greater freedom in planning by making possible designs which actually eliminate steps in fabrication, and lead to lower finished costs in most light and medium construction and maintenance work.

Du Pont Industrial Explosive Rivets simplify the fabrication of products where the design calls for blind riveting or riveting in hard-to-reach places. They remove restrictions imposed by conventional fastening methods and do their job quickly and efficiently.

Since the time they were first made available for general use, millions of these rivets have gone into equipment ranging from ice cube machinery to radar antennas. This wide acceptance is due to the fact that Du Pont Explosive Rivets make blind riveting simple, fast, and economical.



A wide grip range of industrial explosive rivets makes it possible to use the same length of rivet to fasten many different thicknesses of material.



3 Typical members of the Du Pont family of industrial explosive rivets with modified brazier and sunk heads.

Industrial explosive rivets are fast-acting, strong, one-piece fasteners similar in appearance to ordinary solid rivets but with this important exception:

Extending the full length of the shank of the rivet is a small, carefully centred cavity which contains a tiny explosive charge. The application of heat to the rivet head, for as little as one-half second, fires this charge, causing the shank to expand, thus setting the rivet firmly and almost instantaneously.

The setting of these rivets is so quick and easy that they have proved to be definite timesavers on production operations. No bucking bar is needed and one man can easily set them at the rate of 20 to 25 a minute. They are always set from the head side, using a simple, inexpensive, electrically heated riveting iron, or a pneumatic tool fitted with a phenolic resin friction tip.

All types have smooth, finished heads, so no buffing, trimming, or cutting is required. The job is finished as soon as the rivet is set. The shank expands to fill the hole completely, giving a tight joint even with slightly oversize holes. This makes it unnecessary to observe close tolerances in drilling, reducing drilling time, and further speeding up the fastening job by making insertion easier.

There are two types

All Du Pont industrial explosive rivets are available in two types: Regular rivets (Picture 1)—with the familiar open end, and a new development—Blast-free rivets (Picture 2). This new type of rivet is designed for use when the opposite or adjacent structure is very close to the shop end of the rivet. It is practically noiseless when being set.

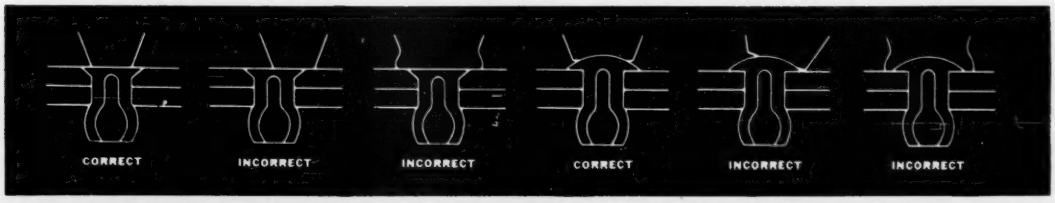
Industrial explosive rivets are available in brass, nickel-plated brass, 52S aluminum alloy, 56S aluminum alloy and nickel. The standard head styles are modified brazier and 100 deg. countersunk.

Brass, nickel-plated brass and 52S aluminum alloy rivets are available in several diameters—1/8 in., 5/32 in., 3/16 in. and 1/4 in.—and with a wide range of grip lengths. Details of 52S aluminum and brass brazier-head rivets appear in Table 1 and 52S 100 deg. countersunk in Table 2. Nickel rivets are available in slightly oversize diameters—.134 in., .171 in. and .202 in., as are 56S aluminum alloy rivets—.202 in. and .263 in. diameters. One of the outstanding advantages of explosive rivets is that a particular size rivet may be used for an unusually wide range of material thicknesses. This reduces the inventory needed for most shop requirements and substantially increases production.

Manufacturers of refrigeration equipment have an endless variety of difficult fastening problems. One manufacturer, for example, had to fasten copper shelves to a copper casing. The rivet holes were hard to reach, and the distortion of the thin sheets, which always took place when ordinary solid rivets were used, had to be eliminated. Explosive rivets did the job simply, neatly and economically, and distortion was eliminated.

Another manufacturer uses these rivets for hard-to-reach places in the construction of ice cream merchandisers. The rivets are used for securing angle iron bases to the bottom of beverage coolers, and for fastening stainless steel aprons at the tops of various cabinets. A neat job results and no polishing, trimming or finishing is required. There is no danger of marring the surfaces with the slip of a screw driver, and the job is tamper-proof.

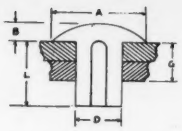
A custom builder of top-quality stainless steel soda fountains, sandwich counters, refrigerators and similar cabinets states that explosive rivets are easier and quicker to install than any other fastener. He saves from 20 to 30 minutes on each unit and also gets a better-looking, more sanitary job. The smooth, solid rivet heads do not gather dirt or food particles to attract vermin. **(continued over page)**



4 There are more wrong ways than right ones of touching off an explosive rivet. It is important to centre the tip on the rivet head. And also there should be no contact between it and the material being fastened.

Table 1. Du Pont Explosive Rivets—Regular Type.

Brazier head—525 Aluminum and Brass.

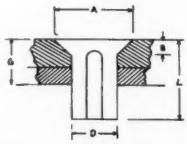


RIVET SIZE D	RECOM-MENDED HOLE & DRILL SIZE	HEAD		NOMINAL GRIP G	GRIP RANGE OR THICKNESS TO BE RIVETED		SHANK LENGTH L	RIVET NUMBER	
		Diameter A	Thickness B		Min.	Max.		52S Aluminum	Brass
1/8" .125"	.126"—.130" #30 Drill	.250"	.050"	1/16" (.063")	.010"	.072"	.176"	52SB—1/8 x 1/16	BRB—1/8 x 1/16
				1/8" (.125")	.073"	.134"	.238"	52SB—1/8 x 1/8	BRB—1/8 x 1/8
				3/16" (.188")	.135"	.197"	.301"	52SB—1/8 x 3/16	BRB—1/8 x 3/16
				1/4" (.250")	.198"	.259"	.363"	52SB—1/8 x 1/4	BRB—1/8 x 1/4
5/32" .156"	.157"—.161" #21 Drill	.312"	.063"	1/16" (.063")	.010"	.072"	.211"	52SB—5/32 x 1/16	BRB—5/32 x 1/16
				1/8" (.125")	.010"	.134"	.273"	52SB—5/32 x 1/8	BRB—5/32 x 1/8
				3/16" (.188")	.073"	.197"	.336"	52SB—5/32 x 3/16	BRB—5/32 x 3/16
				1/4" (.250")	.135"	.259"	.398"	52SB—5/32 x 1/4	BRB—5/32 x 1/4
				3/8" (.375")	.260"	.384"	.523"	52SB—5/32 x 3/8	BRB—5/32 x 3/8
3/16" .187"	.188"—.192" #11 Drill	.375"	.075"	1/16" (.063")	.010"	.072"	.245"	52SB—3/16 x 1/16	BRB—3/16 x 1/16
				1/8" (.125")	.010"	.134"	.307"	52SB—3/16 x 1/8	BRB—3/16 x 1/8
				3/16" (.188")	.073"	.197"	.370"	52SB—3/16 x 3/16	BRB—3/16 x 3/16
				1/4" (.250")	.135"	.259"	.432"	52SB—3/16 x 1/4	BRB—3/16 x 1/4
				3/8" (.375")	.260"	.384"	.557"	52SB—3/16 x 3/8	BRB—3/16 x 3/8
				1/2" (.500")	.385"	.510"	.682"	52SB—3/16 x 1/2	BRB—3/16 x 1/2
1/4" .250"	.254"—.258" F Drill	.500"	.100"	1/8" (.125")	.010"	.134"	.375"	52SB—1/4 x 1/8	BRB—1/4 x 1/8
				3/16" (.188")	.073"	.197"	.438"	52SB—1/4 x 3/16	BRB—1/4 x 3/16
				1/4" (.250")	.135"	.259"	.500"	52SB—1/4 x 1/4	BRB—1/4 x 1/4
				3/8" (.375")	.260"	.384"	.625"	52SB—1/4 x 3/8	BRB—1/4 x 3/8
				1/2" (.500")	.385"	.510"	.750"	52SB—1/4 x 1/2	BRB—1/4 x 1/2

Note—1/4" diameter Rivets should be expanded with Du Pont No. 9A Riveting Iron.

Table 2. Du Pont Explosive Rivets—Regular Type.

100 deg. Countersunk head — 525 Aluminum or Brass.



RIVET SIZE D	RECOM-MENDED HOLE & DRILL SIZE	HEAD		NOMINAL GRIP G	GRIP RANGE OR THICKNESS TO BE RIVETED		OVER-ALL LENGTH L	RIVET NUMBER	
		Diameter A	Thickness B		Min.	Max.		52S Aluminum	Brass
1/8" .125"	.126"—.130" #30 Drill	.216"	.042"	1/8" (.125")	.073"	.134"	.238"	52SC—1/8 x 1/8	BRC—1/8 x 1/8
				3/16" (.188")	.135"	.197"	.301"	52SC—1/8 x 3/16	BRC—1/8 x 3/16
				1/4" (.250")	.198"	.259"	.363"	52SC—1/8 x 1/4	BRC—1/8 x 1/4
5/32" .156"	.157"—.161" #21 Drill	.278"	.055"	1/8" (.125")	.010"	.134"	.273"	52SC—5/32 x 1/8	BRC—5/32 x 1/8
				3/16" (.188")	.073"	.197"	.336"	52SC—5/32 x 3/16	BRC—5/32 x 3/16
				1/4" (.250")	.135"	.259"	.398"	52SC—5/32 x 1/4	BRC—5/32 x 1/4
				3/8" (.375")	.260"	.384"	.523"	52SC—5/32 x 3/8	BRC—5/32 x 3/8
3/16" .187"	.188"—.192" #11 Drill	.344"	.070"	1/8" (.125")	.010"	.134"	.307"	52SC—3/16 x 1/8	BRC—3/16 x 1/8
				3/16" (.188")	.073"	.197"	.370"	52SC—3/16 x 3/16	BRC—3/16 x 3/16
				1/4" (.250")	.135"	.259"	.432"	52SC—3/16 x 1/4	BRC—3/16 x 1/4
				3/8" (.375")	.260"	.384"	.557"	52SC—3/16 x 3/8	BRC—3/16 x 3/8
				1/2" (.500")	.385"	.510"	.682"	52SC—3/16 x 1/2	BRC—3/16 x 1/2
1/4" .250"	.254"—.258" F Drill	.468"	.096"	1/8" (.125")	.010"	.134"	.375"	52SC—1/4 x 1/8	BRC—1/4 x 1/8
				3/16" (.188")	.073"	.197"	.438"	52SC—1/4 x 3/16	BRC—1/4 x 3/16
				1/4" (.250")	.135"	.259"	.500"	52SC—1/4 x 1/4	BRC—1/4 x 1/4
				3/8" (.375")	.260"	.384"	.625"	52SC—1/4 x 3/8	BRC—1/4 x 3/8
				1/2" (.500")	.385"	.510"	.750"	52SC—1/4 x 1/2	BRC—1/4 x 1/2

Note—1/4" diameter Rivets should be expanded with Du Pont No. 9A Riveting Iron.

RIVET MATERIAL	RIVET DIAMETER	RIVET NUMBER	SHEAR STRENGTH		TENSILE STRENGTH	
			Lbs./Rivet	Lbs./Sq.In.*	Lbs./Rivet	Lbs./Sq.In.*
52S Aluminum Brazier Head	1/8"	52SB—1/8 x 3/16	187	15,200	290	23,600
	5/32"	52SB—5/32 x 3/16	291	15,200	441	23,000
	3/16"	52SB—3/16 x 3/16	420	15,200	630	22,900
	1/4"	52SB—1/4 x 1/4	743	15,200	1020	23,000
56S Aluminum Brazier Head	3/16" (.202")	56SB—202 x 1/8	800	25,000	900	28,000
	1/4" (.263")	56SB—263 x 1/4	1360	25,000	1540	28,000
Brass Brazier Head	1/8"	BRB—1/8 x 3/16	425	34,600	603	49,200
	5/32"	BRB—5/32 x 3/16	641	33,600	882	46,100
	3/16"	BRB—3/16 x 3/16	874	31,900	1345	51,700
	1/4"	BRB—1/4 x 3/8	1350	28,600	2200	45,000

Table 3

Single shear and tensile strength data for typical industrial explosive rivets taken from test results.

Explosive rivets *(continued)*

Du Pont industrial explosive rivets give strong joints, comparable to those made with solid rivets. The rivets are applied quickly and simply from one side only, and no secondary finishing or dressing operations are required. The complete job is neat and smooth.

Single shear and tensile strength data for typical industrial explosive rivets are shown in Table 3. All tests were for single riveted steel specimens having recommended size holes.

Riveting irons and tips

Three electric riveting irons are available for use with Du Pont industrial explosive rivets. They are designated as No. 7, No. 8, and No. 9A Riveting Irons and are rated at 200, 300, and 675 watts, in the order named.

The No. 9A Riveting Iron, with 9A-S140 tip, is recommended for use with the brake shoe explosive rivet.

For test results, the tip should fit the particular size and head type of rivet being used. All three sizes of riveting iron are designed to handle tips for either brazier or countersunk heads in all diameters.

One person, working from the head side of the rivet, can easily install these high-speed fasteners in two simple steps:

The explosive rivet is placed in a previously drilled hole. Close tolerances are not required. Then, the heated tip of an inexpensive riveting iron (or an approved soldering iron) is applied to the rivet head. In as little as one-half second the charge fires, expanding the shank to fill the hole completely.

When expanded, the shank of the rivet forms a barrel-shaped head on the opposite side of the work to lock it permanently and securely in place. No pneumatic hammer, bucking bar or other awkward or expensive equipment is needed. No finishing operation is necessary and there are no parts to work loose due to vibration. A uniformly neat, smooth, strong, tight, tamperproof job of fastening is obtained quickly. ★

RIVET METAL	COMMERCIAL SHEET					
	Aluminum Alloys	Copper and Brasses	Magnesium Alloys	Monel Inconel	Plain or Galvanized Steel	Stainless Steels
52S aluminum	Yes	No	No	No	Yes	No
56S aluminum	Yes	No	Yes	No	Yes	No
Brass	No	Yes	No	Yes	Yes	Yes
Nickel (L Nickel alloy)	No	Yes	No	Yes	Yes	Yes
Nickel plated brass rivets	No	Yes	No	Yes	Yes	Yes

Table 4

Rivet metals sometimes conflict with sheet to be riveted. So what can you use with what? See the answers above.

What you should know about the V-belt

If you think you can use any kind of belt in any kind of situation, you are heading for trouble. Read this article to avoid the common mistakes

Throughout the history of the V-belt drive, more modifications have been made in the construction of the V-belts themselves than in the grooved sheaves over which they run. This is because the sheaves are usually made of metal and are little affected by extremes of temperature, humidity and other atmospheric conditions. The belts, however, which are of animal or vegetable origin (natural or synthetic), require particular safeguards when used in certain situations.

A V-belt Drive (see fig. 1) consists of a driver and a driven sheave, pronounced "shiv." This is essentially a pulley with angled grooves cut in its face to take one or more individual belts of trapezoidal cross-section, commonly referred to as V-shaped.

When it has two or more parallel belts working together, each transmitting a share of the load, it is known as a multiple V-belt drive (see fig. 1). Use of controlled length, resilient belts and precision-grooved sheaves assures equalization of load among all belts on the drive.

Note that a V-belt does not touch the bottom of the sheave grooves. It is the wedging action between the angled sides of the belts and the angled sides of the sheave that transmits the power. If a V-belt touches the bottom of the groove there is less wedging action.

Why write about V-belts?

The multiple V-belt drive was originated more than a quarter century ago and is now in use throughout the world. Because it is efficient, dependable and simple, it has gained a solid reputation among mechanical power transmission engineers everywhere.

But, in spite of its popularity, little has been written (other than in sales literature) about the principles of this type of power transmission. Few engineering textbooks contain more than a passing reference to the problems of V-belt engineering although there is need for information about it.

Now, this article gives a true picture of the multiple V-belt drive to help the engineer avoid some of the common mistakes.

The following types of special belts are usually available:

Heat Resisting. A belt which is highly resistant to heat due to the special treatment of cords and rubber compounds in its manufacture.

Oil Resisting or Oilproof. A belt which has cover and core made of Neoprene so that it is practically impervious to the deteriorating effects of petroleum oil, grease and many acids and alkalies.

Static Conducting. A belt that has a static conducting element impregnated in the cover and core so that the belt itself will conduct static electricity safely to the grounded motor and driven machine without risk of an electric spark.

The outside dimensions of V-belts now on the market are standard. There are five sizes, as shown in fig. 2, designated A, B, C, D and E sections. Each is progressively larger and stronger.

Belt widths along the outside face are as follows:

A—½ in. B—21/32 in.
C—⅞ in. D—1¼ in. and E—1½ in.

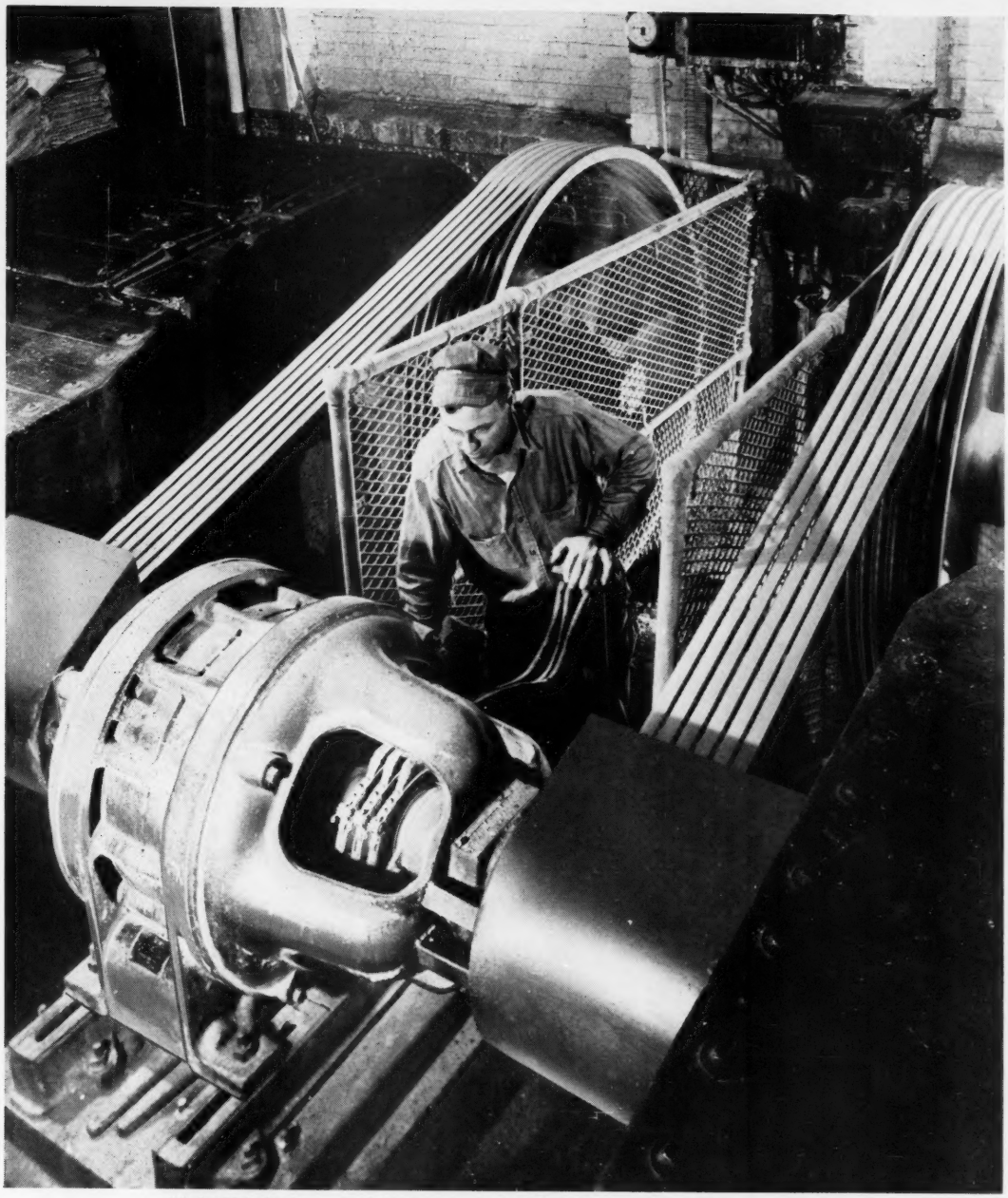
It would not be practical to adopt as standard a small belt suitable for the smallest drives in industry. When larger horsepower was called for, the drive would need so many belts.

The interior construction varies widely and can be divided roughly into the three styles illustrated in fig. 3. (1) Laminated construction, with the pulling cords spaced in the outer part of the belt with a cushion of rubber on the inside face; (2) laminated construction in which the cords are spaced uniformly throughout the core of the belt; and (3) gromment construction, in which the cords are grouped in endless twists, with a cushion of rubber on the inside face.

Each company manufacturing V-belts uses its own style of construction in making these various types of belts.

V-belts developed in recent years, wider and thinner than conventional types, are known as wide range belts (QRST and W sections) and must be used in correspondingly wide grooves. They are mostly for wide range, variable pitch sheaves (and their companion sheaves) and for variable-speed transmissions. While the sides of the belts have less area of contact with the sheave groove walls, they produce a greater speed range by effecting a greater extreme between the possible minimum and maximum pitch diameters of a variable pitch sheave.

V-belts which are specially selected to work together in unison on the same drive are known as matched sets. Due to variables in manufacture, the length of endless V-belts cannot be precisely controlled. Most V-belts are measured for length immediately after manufacture.



Multi V-belt drive used for beaters installed at the Flambeau Paper Company.

Motor Hp	Motor or driven machine speed, whichever is the greater											
	3600	3200	2800	2400	2000	1800	1450	1200	900	720	600	450
10	B	B	B	B	B	B	B	B	B	C	C	C
15	B	B	B	B	B	B	B	B	B	C	C	C
20	B	B	B	B	B	B	B	B	B	C	C	C
25	B	B	B	B	C	C	C	C	C	C	C	C
30	B	B	B	B	C	C	C	C	C	C	C	C
40	B	B	B	B	C	C	C	C	C	C	C	C

Table 1

Use this table to select the proper belt sections. Example: For a motor of 25 hp nominal (line 4) and a driven machine speed of 1,200 rpm, use a C belt section.

Section	Min. Pitch Diameter	Recommended Range of Small Sheave Diameters
A	3.0	3.0 — 5.0
B	5.4	5.4 — 7.4
C	9.0	9.0 — 13.0
D	13.0	13.0 — 17.0
E	21.6	21.6 — 28.0

Table 2

Minimum pitch diameter of motor sheave is 9.0 in.

V-belt drives *(continued)*

The **Pitch Line** of a V-belt (fig. 4) is a theoretical and imaginary median line within the belt, used for measurement and calculation. It corresponds in theory to the pitch line of gears. The position of the pitch line depends on the construction of the belt and the location of the tension and compression members. Theoretically, it is at the neutral axis of the belt, but it can usually be assumed as being at the half depth of the belt.

The **Pitch Length** of a belt is the lengthwise measurement taken along the pitch line. **Pitch Diameter,** of a sheave, is the diameter of the circle whose circumference coincides with the belt's pitch line position when running in the sheave groove.

The standard endless V-belt is designed to bend in a normal, easy arc as it turns around a sheave. Naturally, the belt arc corresponds to the sheave pitch diameter. If the belt is used with a sheave of too small diameter, it will distort and its life will be shortened. Here are recommended minimum pitch diameters of sheaves for standard V-belts cross sections.

Belt Section	Minimum Pitch Diameter (In.).
A	3.0
B	5.4
C	9.0
D	13.0
E	21.6

3 to 10 Grooves Pitch Diameter		
8.5	10.0	20.0
9.0	10.2	24.0
9.2	10.6	30.0
9.4	11.0	36.0
9.6	13.0	44.0
9.8	16.0	50.0

Table 3

Both 9.4 and 24 stock sizes.

Table 4

Closest stock belt to choose will be C128.

C—Cross Section 7/8" Wide x 17/32" Thick x 40° Angle		
Size No.	Pitch Length Inches	Outside Circumference Inches
C 51	53.9	55.2
C 60	62.9	64.2
C 68	70.9	72.2
C 75	77.9	79.2
C 81	83.9	85.2
C 85	87.9	89.2
C 90	92.9	94.2
C 96	98.9	100.2
C105	107.9	109.2
C112	114.9	116.2
C120	122.9	124.2
C128	130.9	132.2
C136	138.9	140.2
C144	146.9	148.2
C158	160.9	162.2

Speed Ratio	Small Diameter Factor
1.275 — 1.340	1.09
1.341 — 1.429	1.10
1.430 — 1.562	1.11
1.563 — 1.814	1.12
1.815 — 2.948	1.13
2.949 and over	1.14

Table 5

Small diameter factor is taken as 1.13.

The Optimum Pitch Diameter is the most favorable pitch diameter possible. It is not less than the minimum recommended diameter, yet large enough to produce the highest belt speed well within the maximum of 5,000 fpm. A belt has a greater horsepower capacity at higher speeds, of course.

As long as a V-belt drive has the proper belt tension the direction of running does not matter. It may be started, stopped and reversed as readily as a motor. Consequently, the tension can be either at the top or the bottom of a horizontal drive, depending on the direction of rotation of the driven shaft (see fig. 5). Where there is a choice of having the tension on the top or the bottom side of the drive, there are two factors to consider. One is appearance. A belt drive with the tight (or tension side) on top looks better to the casual observer. Purely from the standpoint of efficiency, it is better to have the tension side at the bottom to avoid lessening the arc of contact.

You can work it all out

The principles of engineering a multiple V-belt drive are well established. Starting with known factors, such as the horsepower and speed of the prime mover and the type and speed of the driven machine, it is possible to determine accurately, the proper sheaves, the centre distance, how much horsepower one belt of the proper size and length will transmit and how many of these belts will be required to transmit the total horsepower.

While methods may vary, all make use of the same basic facts relating to sheave size, speed ratio, effective sheave diameter, belt rating, belt length, rpm, horsepower, and driver and driven machine characteristics. In the following calculations which are typical, each step is explained as fully as possible by reference to tables.

To select a V-belt drive to transmit power from a 25-hp squirrel-cage motor, with full-load speed of 1,160 rpm, to a ventilating fan to run at 450 rpm. Centre distance equals approximately 40 in. (fig. 7).

Since the fan is to run at a lower speed than the motor, this is a step-down drive. The smaller sheave is used on the motor and the larger sheave on the fan.

Speed Ratio

$$R = \frac{\text{motor rpm}}{\text{fan rpm}} = \frac{1160}{450} = 2.57$$

This is also the ratio of the sheave sizes.

From Table 1, for 25 nominal motor hp, a C section belt corresponds to 1,200 rpm.

Pitch Diameter of Sheaves

Minimum pitch diameter (P.D.) of motor sheave (from Table 2) is 9.0 in.

Actually, 9.4 is used since a slightly larger value than the minimum gives longer belt life.

P.D. of fan sheave= 9.4 x 2.57=24. Both 9.4 and 24 are stock sizes (see Table 3).

Tentative Belt Length (L)

If D=P.D. of large (fan) sheave= 24 in.
d=P.D. of small (motor) sheave=9.4 in.
C=centre distance=40 in. approx.
R=speed ratio, then

$$L = 2C + 1.57\,(D+d) + \frac{(D-d)^2}{4C}$$

Here are some standard combinations and types of the V belt drive

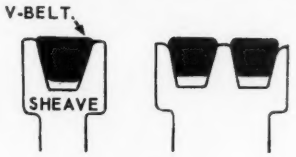


Fig. 1. Simple single V-belt drive (left) powerful multi drive (right).

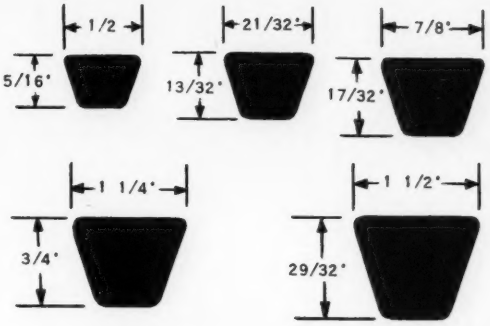


Fig 2. There are five standard belt sizes — all are shown here (right).

Fig 3. Interior construction of V-belts varies greatly. Can be divided into the three styles shown — Grommet type, right.

Fig. 4. The pitch line is a theoretical and imaginary median line within the belt used for all calculation purposes.

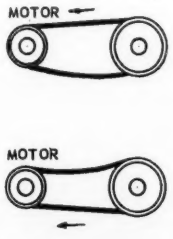


Fig 5 (left). Top sag has a sloppy look so it is best to keep the top belt in tension.

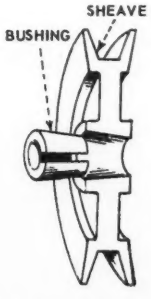
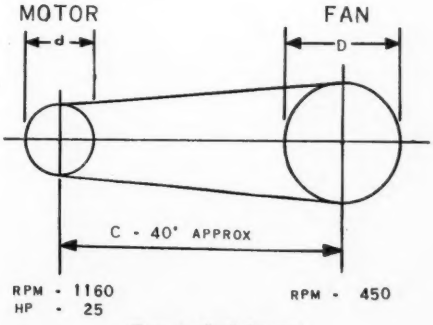


Fig 6 (right). Most stock sheaves today are equipped with modern taper sleeve bearings.



One typical layout

Fig. 7. Layout of a V-belt drive to transmit power from a 25 hp squirrel-cage motor to a ventilating fan — centre distance, about 40 in.

	BELT SPEED IN FEET PER MINUTE																	
Effective Diameter	1000		1500		2000		2500		3000		3500		4000		4500		5000	
	Std.	HC*	Std.	HC	Std.	HC	Std.	HC	Std.	HC	Std.	HC	Std.	HC	Std.	HC	Std.	HC
6.0	3.0	3.9	4.0	5.3	4.9	6.5	5.6	7.5	6.1	8.2	6.4	8.7	6.4	9.0	6.1	8.9	5.5	8.6
9.0	3.3	4.4	4.6	6.1	5.7	7.6	6.5	8.8	7.2	9.8	7.7	10.6	7.9	11.1	7.8	11.4	7.4	11.3
C 10.0	3.6	4.9	5.0	6.8	6.3	8.4	7.3	9.9	8.1	11:1	8.7	12.1	9.1	12.9	9.1	13.3	8.9	13.4
11.0	3.9	5.2	5.4	7.3	6.7	9.1	7.9	10.8	8.8	12.2	9.6	13.4	10.0	14.3	10.2	14.9	10.1	15.2
12.0 or larger	4.1	5.5	5.7	7.7	7.2	9.7	8.4	11.5	9.5	13.1	10.3	14.4	10.9	15.4	11.1	16.2	11.1	16.7

Table 6. *By interpolation, using the effective diameter at a belt speed of 2856 fpm, standard hp rating 8.0.*

V-belt drives *(continued)*

Continuing with the calculation for tentative belt length:

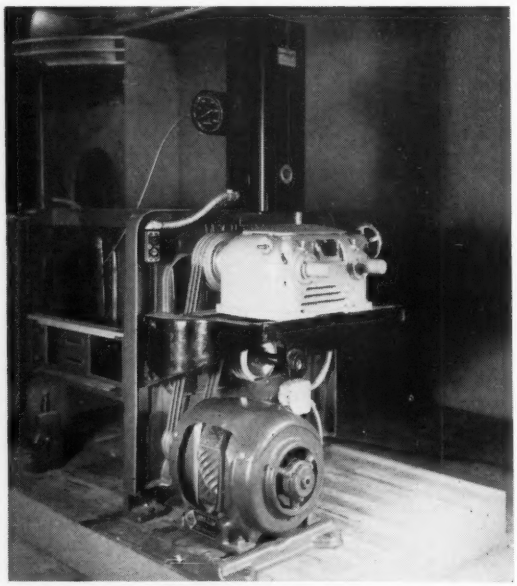
$$2C = 2 \times 40 = 80$$
$$(D+d) = 24 + 9.4 = 33.4$$
$$1.57\,(D+d) = 52.4: \quad (D-d)^2 = 14.6^2 = 213$$
$$\frac{(D-d)^2}{4C} = \frac{213}{160} = 1.333$$

$$L = 80 + 52.4 + 1.333 = 133.73 \text{ in.}$$

The closest stock belt (Table 4) is C128 with a pitch length L^1 of 130.9 in.

Arc	180°	170°	160°	150°	140°	130°	120°
Factor	1.00	.98	.95	.92	.89	.86	.82

Table 7. *Arc of contact correction factor, for giving the horsepower capacity retained by the belt equals .95.*



A multi V-belt drive at work. It is being used on a vari-pitch speed changer to drive a Whitin End Frame.

Exact Centre Distance (C_1)

Using the closest stock belt

$$2C_1 = L^1 - 1.57\,(D+d) - \frac{(D^2 - d^2)}{1.57\,(L-R)}$$

$$1.57\,(D+d) = 52.4$$
$$D^2 = 576, \quad d^2 = 88.1$$
$$(D^2-d^2) = 487.9$$
$$(L-R) = 130.9 - 2.57 = 128.33$$
$$1.57\,(L-R) = 203$$
$$2C_1 = 78.5 - 2.3 = 76.2$$
$$C_1 = 38.1 \text{ in.}$$

The ideal centre distance is between 1 and 1½ times the diameter of the large sheave. Actually, centre distances may be as short or as long as conditions dictate. The V-belt drive is inherently a short centre drive and the best results are obtained when the centres are as short as reasonably possible. Short belts cost less and require less maintenance.

HP One Belt will Transmit

(a) Belt speed $= \frac{\pi \times d \times \text{motor rpm}}{12}$

$$= \frac{\pi \times 9.4 \times 1160}{12} = 2856 \text{ fpm}$$

This should never exceed 5,000 fpm.

(b) **Effective diameter of sheave.**

On a drive of greater than 1 to 1 ratio the flexing action of the belt is less on the larger sheave than it is on the smaller. The modern method of V-belt drive calculation compensates for this less severe flexing action on the larger sheave by correlating the flexing effect on both sheave diameters. The small sheave factor, determined by sheave ratio in the small diameter factor table, multiplied by the actual pitch diameter of the small sheave, equals the effective diameter which is used in computing the horsepower transmitting capacity of the belt.

From Table 5, small diameter factor is 1.13 for a speed ratio of 2.57 as given by the range (1.815 to 2.948).

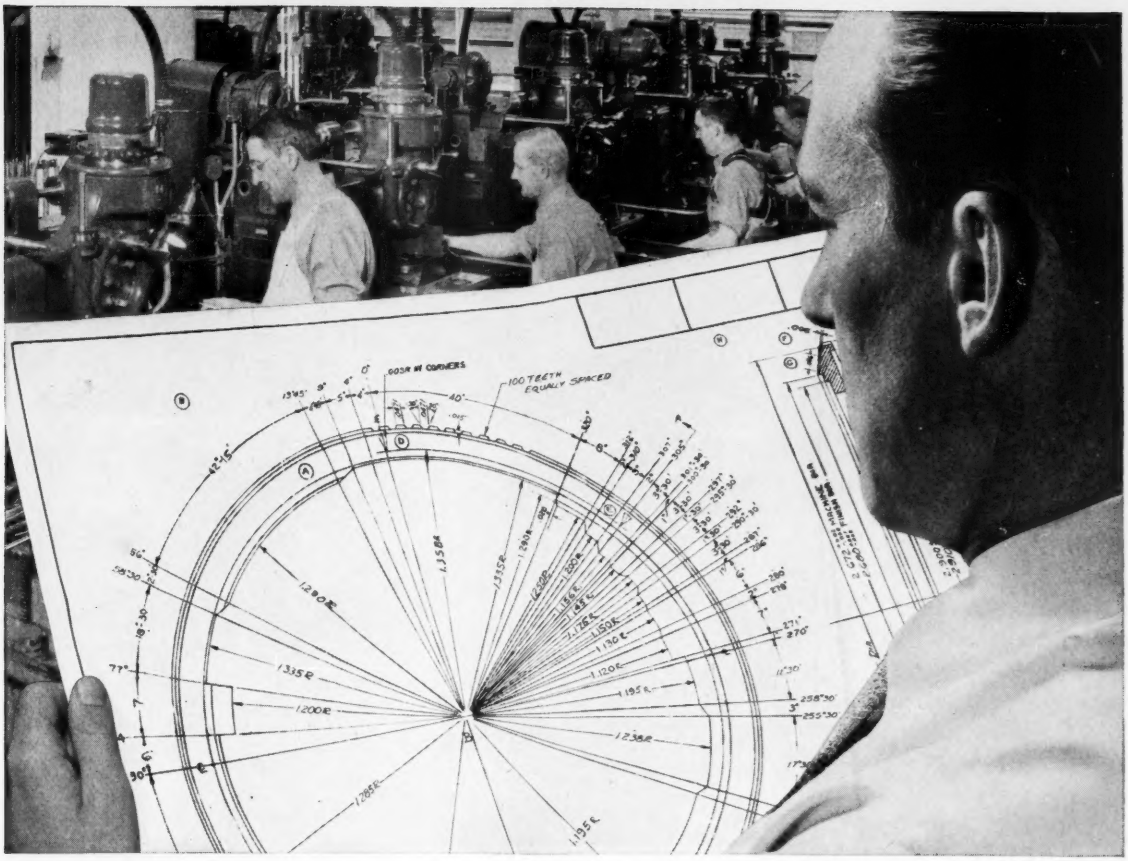
(c) **Effective diameter** $= 1.13 \times 9.4 = 10.6$ in.

By interpolation from Table 6, using this effective diameter at a belt speed of 2,856 fpm, hp rating of a standard belt = 8.0 and of a high capacity belt = 11.0.

(d) **Arc factor**

Horsepower ratings for different size V-belts are based on 180 degree arc of contact between belt and

(Continued on page 87)



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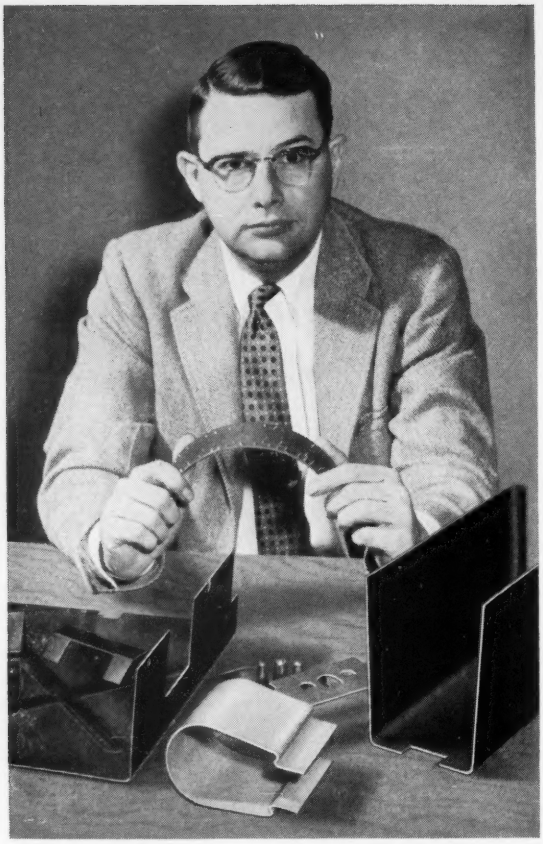


R. F. Bogart, one of National's staff of applications engineers, shown holding a postformed copper clad PHENOLITE printed circuit.

Reverse bends and small radii—toughest problems in forming—were involved in shaping this spring-action, snap-on cover for a switch voltage changer. National's postforming technicians used PHENOLITE C-534-F to achieve a 1/16" radius bend.

Corrugated, bent, and punched after forming, this insulator had to be made of extraordinary stock to withstand unusual stresses. National made use of a double die and PHENOLITE C-534-F to form the corrugated component without cracking or fracturing the piece.

Bending and drawing in one operation were difficulties faced in forming this bus bar joint cover. National ended the trouble by using PHENOLITE X-114-A. PHENOLITE can be formed or deep drawn easily—without damage to the material and without expensive dies.

How fast can you wrap a stator core?

Now electric motor assemblies can be formed and welded in just 36 sec.

Designed to reduce the time consumed in wrapping electric motor stator cores, a special automatic welder has just been built by Standard-Modern Tool Company Limited.

This special machine was built for a new, fractional horse-power, electric motor plant at Stratford, Ontario. The average floor-to-floor time for precision forming and welding these assemblies has been reduced to thirty-six seconds, a small fraction of the time originally taken. All the operator has to do is place a strip of flat steel with preformed ends under the wound stator core, which is held on a central spigot, and press the cycle-start buttons.

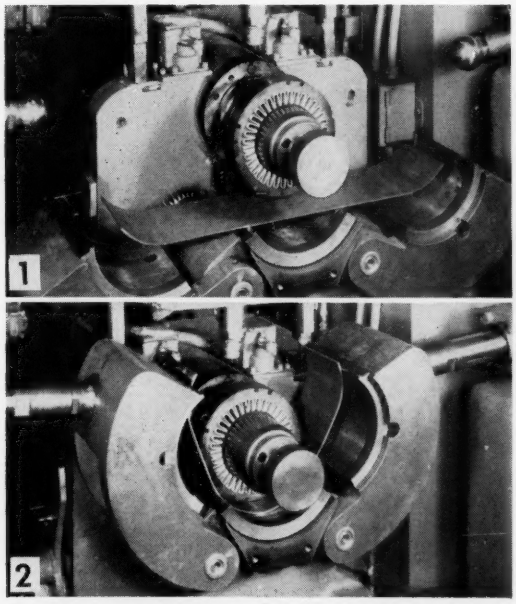
Hydraulically operated steel jaws wrap and clamp the strip around the core, leaving a gap of about one thirty-second of an inch. With an inert gas shield and wire filler the gap is then welded automatically. Shrinkage of the weld permanently binds the core and shell together. The forming jaws then automatically release the completed assembly for removal by hydraulic means.

This operation, which formerly was a slow and troublesome hand operation in the production of fractional horse-power electric motors, is now reduced to a swift, accurate and uniform production process taking thirty-six seconds average floor-to-floor time.

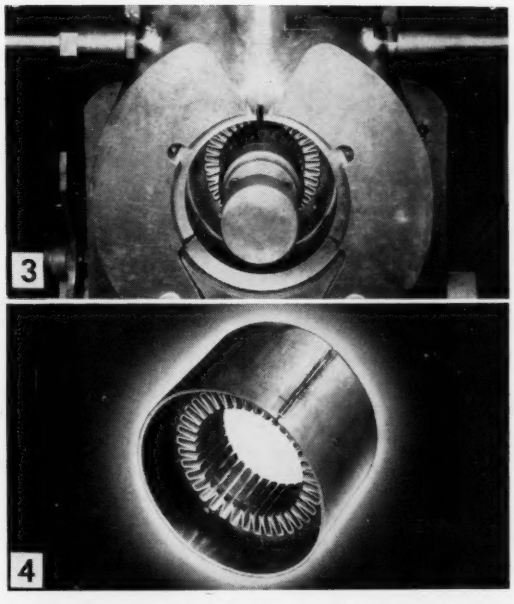
One of the chief problems tackled and solved by Standard-Modern design engineers arose when the customer modified the stator design from a completely round assembly of laminations to one with four flat surfaces. The purpose here was to economize on stock in production of the stator laminations. These flat surfaces produced a stator core assembly with similar flats which were considered undesirable by sales management.

Standard-Modern Tool then set out to modify the already constructed machine to overcome this problem. It was done by incorporating front and back forming rings on the central spigot, the back ring with a reversed taper and a shot-blasted surface to increase its coefficient of friction. The front ring was chrome-plated and tapered so as to reduce its coefficient of friction. This refinement facilitated prior removal of the front ring and subsequent hydraulic removal of the completed assembly from the rear ring. Tapers of 7/1000 were incorporated to facilitate the difficult removal operation.

The automatic welding process requires standardized stock for efficient welding with the wire and flux which is used in the machine. ★



1 Place a strip of flat steel (with perforated ends) under the stator core and press cycle-start buttons. 2 Steel jaws wrap and clamp the strip around the core but keep its ends apart by one thirty-second of an inch.



3 With an inert gas shield and wire filler, the steel wrap is welded automatically, then bound by shrinkage. 4 The folding jaws release the finished assembly for removal (hydraulically). Total job time: 36 seconds.

New products & materials

New items which can help you on the job

PRECISE ATTENUATION, broad frequency coverage, compact size and a low price are features of a newly produced **Hewlett-Packard Co.** audio oscillator.

The new oscillator covers frequencies 20 cps to 20 KC in three bands with calibration accuracy of 1%, frequency stability of 2% or 0.2 cps, and full range frequency response of 1 db. Output is 3 watts or 42.5 volts into 600 ohms. Distortion is less than 0.5% from 50 cps to 20 KC at 1 watt, and less than 1%, 20 cps to 20 KC at 3 watts output.

Hewlett-Packard's audio oscillator

An output attenuator lowers the output 40 db in steps of 10 db. With zero attenuation the internal impedance is approximately 75 ohms.

With 10 db or more attenuation the output impedance is approximately 600 ohms over the entire frequency range providing the entire frequency range providing a constant internal impedance for precise audio measurements. Hum voltage is less than 0.03% of rated or attenuated output.

The Model 201C can be used in low distortion, high-accuracy measuring such as amplifier, loudspeaker, frequency comparison and other high fidelity measurements. (200)

• • •

Captivated contact comes from U. S.

AN ENTIRELY NEW RF connector design has been announced by the AMERICAN PHENOLIC CORPORATION. This design, patent pending, features a contact captivated within the connector shell for assured circuit continuity under great extremes of temperature fluctuation. Captivated contact RF connectors will counteract the dimensional instability of cable dielectrics, (particularly Teflon) under extremes of hot and cold. By anchoring the contact within the connector shell the contacts remain fixed in position even when the dielectric shrinks. A plug, panel jack and jack in both Series N and Series HN have been designed using this captivated contact concept. (201)

• • •

Gear assemblies without backlash

ANTI-BACKLASH GEAR ASSEMBLIES have been marketed as a standard stock item by the DYNAMIC GEAR CO., INC. The pitch diameters range from 1 to 2 inches. They are available in 14½ deg. or 20 deg. pressure angles and in 48, 64, 72, 80, 96 or 120 diam. pitch. (202)

• • •

New multi-purpose rule offered

A NEW IMPROVED version of the Caliputer, a precision measuring and calculating instrument for engineers, scientists, skilled craftsmen and even the family handyman, is now on the market.

Manufactured by CALIPUTER, the stainless steel instrument combines the functions of a slide rule vernier caliper and vernier depth gauge and computer in a single and inexpensive unit.

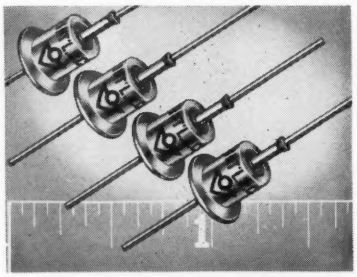
One of the new features is an adjustable vernier scale which allows for easy maintenance and life-long accuracy. Purple enamel is also used in the precision-etched scale lines for better light reflection and easier, sharper reading.

The pocket-sized Caliputer is made of satin-finish type 302 stainless steel, and measures 4¾ in. long, 1½ in. wide and ⅛ in. thick. Combining several commonly used devices into a single unit, the Caliputer provides direct readings of circumferences and cross-section areas. The slide rule will multiply, divide, find squares and square roots. A machinist, for instance, can read directly the correct lathe speed setting in revolutions per minute by setting the rule to the diameter of stock used and by supplying the proper feed rate. (203)

• • •

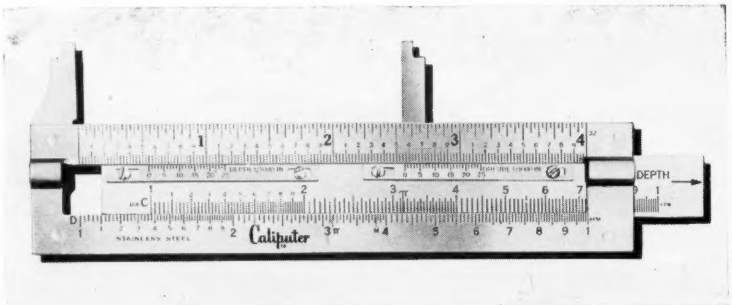
Reliability claimed for new diodes

SILICON POWER diodes designed for use where reliability, high efficiency and miniaturization, together with the ability to withstand high ambient temperatures are prime requirements, have been marketed by the INTERNATIONAL RECTIFIER CORPORATION. These diodes are rated for 300 ma d-c rectified output current when mounted by leads in free air at ambient temperatures up to 100 deg C. When mounted on cooling fins, the diodes can be rated for 1.25 amps. rectified output current at a case temperature up to 150 deg. C. The peak inverse voltage ratings range from 50 v to 600 v.

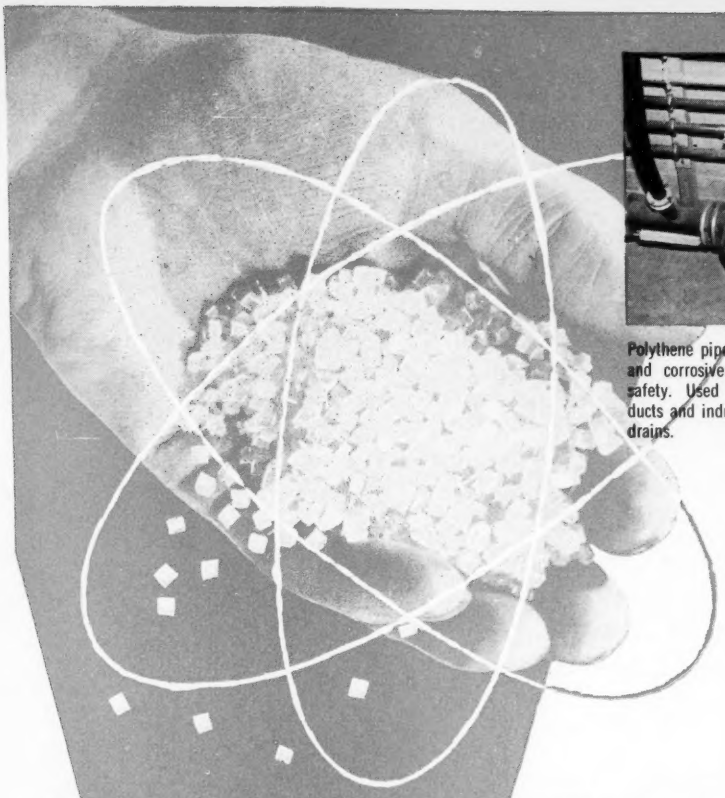


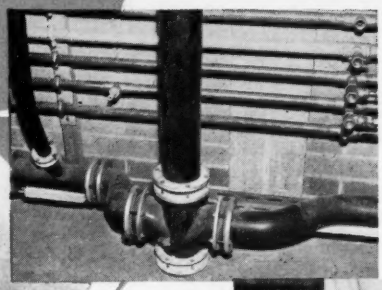
The new silicone power diodes

The rectifying barrier of this silicon diode is formed by the fused junction principle, which results in excellent electrical and mechanical stability. This junction is hermetically sealed in an all-welded, shock-proof housing with pigtail leads firmly and durably welded to the terminals. No solders or fluxes are used in sealing the diode, thus assuring complete absence of contamination. (204)



The new calculator for engineers and scientists





Polythene pipe conducts acids and corrosive materials with safety. Used also for fume ducts and industrial laboratory drains.

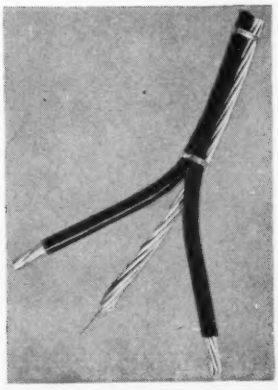
Polythene "trim" on cathode plates prevents zinc deposit "bridging" and assures easy removal.

Modern Science and Industry are Finding More Uses for Polythene Every Day

polythene items can be easily moulded, extruded, heat sealed, are completely shatter-proof, offer resistance to acids which attack glass, have exceptional dielectric properties, remain flexible and strong in continuous subzero cold, are so light they float in water.

Polythene film drum liners hold highly corrosive chemicals and fluids safely without contamination.

Polythene insulated triplex cable takes the place of 3 ordinary wires, saves on installation costs and maintenance — has a neater appearance.



Can Polythene Lower Costs and Solve Problems in YOUR Business?

C-I-L supplies polythene resins and compounds to converters—does not make the finished products shown.

C-I-L polythene

PLASTICS DIVISION - SUPPLIERS OF PLASTIC RAW MATERIALS

New Products

(continued)

VARIOUS COMPONENT ARRANGEMENTS of the Servomation (modular) building blocks manufactured by the SERVO CORPORATION OF AMERICA provide the means for industrial control, problem solving (for both mathematical equations and control system design), data processing and classroom demonstration and experiment. The assemblies match each other in all the important mechanical and electrical specifications. Flexibility, achieved by plug-in units, jack boards and external patch cord connections, allows easy rearrangement of units and additional components at any time.

Among the electronic assemblies are two signal amplifiers. The 2313 a-c type is designed for 400 cps carriers. Its frequency response is ±1% from 300 to 500 cps. Harmonic distortion is 1% or less. A selector switch sets voltage gains of 1x, 10x and 50x. The maximum output is 25 volts rms. The 2314 d-c signal amplifier is a direct coupled amplifier for signals from 0 to 4 kc. Compensated for filament drift, it has a zero stability equivalent to 10 mv at the input. Gains may be adjusted from 0 to 50. Cathode follower output is linear to ±25 volts. (205)

• • •

Canadian clip to be copied in U. S.

THE ATTACHMENT of insulation to steel roof decking is now much simpler and more efficient than ever before—thanks to the efforts of two Canadian companies working hand in hand to solve a difficult problem. The result: a Canadian development now being adopted in the U. S.

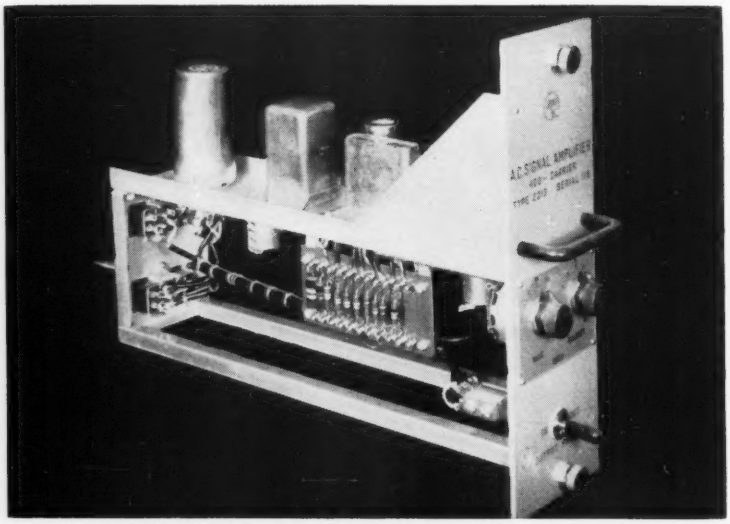
THE ROBERTSON-IRWIN LTD., major suppliers of steel roof deck to the Canadian construction industry, were looking for a means of fastening insulation of all types to their steel roof deck which would eliminate the precarious fire hazard. They presented their problem to DOMINION FASTENERS LTD., manufacturers of Speed Nut brand spring tension fasteners. After a great deal of experimenting and development they designed a fastener that solved the fire hazard as well as all major installation problems.

The fastener, known as a Speed Clip, is made from high quality, heat-treated spring steel. Its application is fast and simple and when man hours and materials are considered, it is proving to be economical. The Speed Clip method eliminates the necessity of piercing the deck. The hazards and high costs of winter construction are eliminated and a sure, permanent attachment is provided. The clip is inserted into the flute of the roof deck against the insulation board and a simple tool is positioned on the foot of the clip and given one or two sharp blows with a hammer. (206)

• • •

New six-blade fan now offered

A LOW-COST six-bladed fan with reduced axial depth has been developed by the TORRINGTON MANUFACTURING CO., primarily as a condenser fan (with a slinger ring) in room air conditioners. Another axial-type impeller, with four or six blades, has a 12-in. tip diameter and can be used with either a solid or a rubber-bushed hub. The new fan is produced in a wide variety of pitches. (207)



One of the Servo Corporation's signal amplifiers

Flame plating

(continued from page 47)

"finished coatings" uses which show other job types the process can handle:

Turbine Engine Seals. The large compressor seal for one maker's aircraft turbine engine contains two stainless steel rings which rotate at near shaft speed. The rings mate with and are retained by a flame-plated sleeve. This seal operates at about 600 deg F with little or no lubrication. The smaller seal consists of a sliding, cylindrical bushing subject to vibration and having a relative 0.350-in. axial travel in the flame-plated coated retainer. This seal operates substantially without lubrication at nearly 800 deg F.

Of all the materials tested by this manufacturer, only flame-plated tungsten carbide had the necessary combination of properties for these jobs.

Pump Bushings. Another application using a combination of advantages obtained only with flame-plating is in bushings for ball piston pumps. The ball pistons ride in flame-plated bushings inserted in the cylinder block. Solid carbide inserts were first used but the differences in thermal expansion between the carbide insert and the steel ball and cylinder block caused the pump to break down. The problem was solved by designing a steel bushing that could be flame-plated. This bushing had the same coefficient of thermal expansion as the steel ball and cylinder.

Dies. At one automotive plant, a flame-plated cold forming die had an increased life of 75% and eliminated 70 hours down time needed for polishing the tool steel die formerly used.

Measuring Devices. Many major manufacturers are using flame-plated plug, ring, air and specialty gauges. The flame-plated gauges are superior in wear resistance to solid sintered tungsten carbide gauges yet they are less fragile. Another big advantage is the flame-plated gauge blanks which can be made from metal which is identical with the metal of the part being gauged. This means that the coefficients of thermal expansion will also be identical thereby resulting in the elimination of temperature compensation problems.

The process is still quite new. Yet it has many successful uses already behind it, to show that its potential is enormous. Its usefulness and popularity will grow even faster when new coating materials are developed and new uses for them discovered. Flame-plating is going to be an important part of industrial practice — it will be worth watching. ★

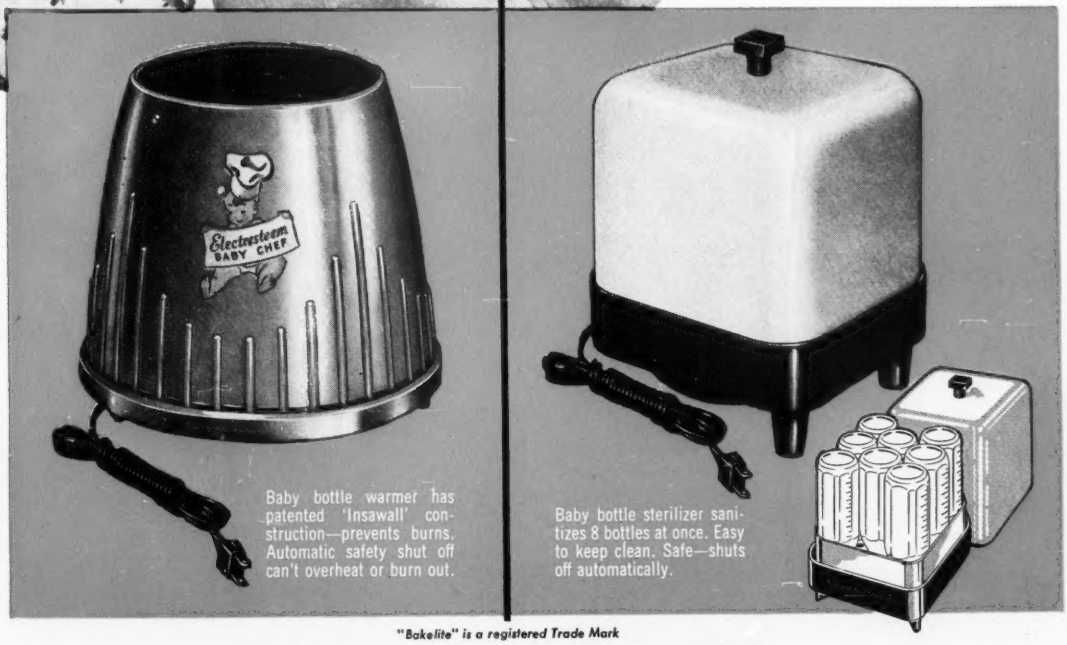
BAKELITE

TRADE-MARK

"Makes it better for Babies!"

Illustrated below are two imaginative applications for "Bakelite" phenolics. The wide variety of "Bakelite" phenolics offers many characteristics worth investigating —chemical and water resistance, improved impact and superior electrical insulating quality, faster moulding cycles, excellent heat resistance.

Both the applications here are moulded for The Electric Steam Radiator Company Limited, Toronto, Ontario by Rainbow Plastic Limited, Buckingham, Quebec.



Baby bottle warmer has patented 'Insawall' construction—prevents burns. Automatic safety shut off can't overheat or burn out.

Baby bottle sterilizer sanitizes 8 bottles at once. Easy to keep clean. Safe—shuts off automatically.

"Bakelite" is a registered Trade Mark

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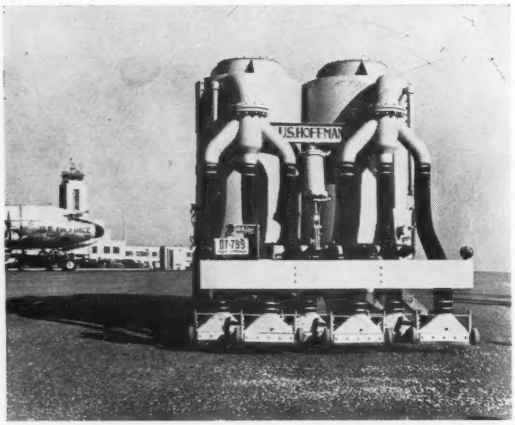
Design news in pictures

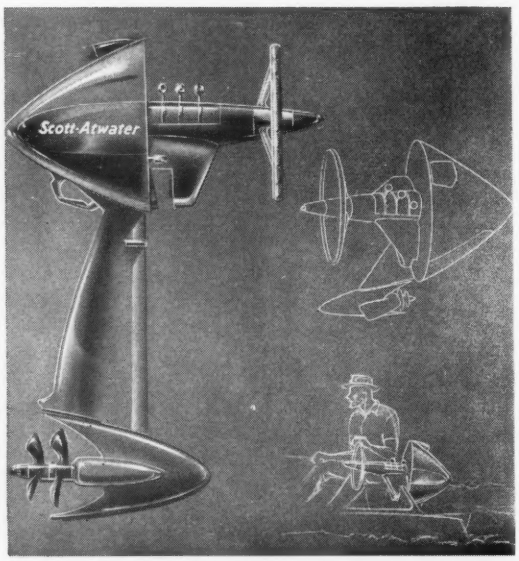
Some modern designs making news today



What is it? Business end of (world's largest vacuum cleaner) the "JARC" which is an aircraft runway cleaner, is latest aid to aviation housekeeping. Runways used by jets must be free from loose bits, pieces, so 50-ton Hoffman apparatus is assigned job.

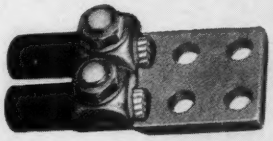
All-plastic body of this delivery truck was made by the Canadian firm of Wilson at Long Branch, Ontario. Extremely high cost of producing the body prevented mass-manufacturing of the unit. Advantages, although numerous, were outweighed in the over-all ($) picture.

Reactor is loaded for shipment in this unusual picture taken from above tracks at Newport News, Va. Extreme care must be taken in handling equipment like this which is not only heavy but inclined to be unmanageable because of the protrusions on it.

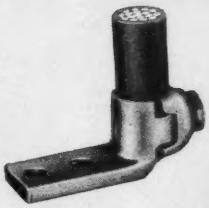


On the way is this dream motor of the outboard future. One of seven in sketch form by Scott-Atwater. It is equipped with a radial engine, counter-rotating propellers. Auto-type steering wheel could be removed for remote control of the coming XX-1965.

how's your QA-IQ?



TYPE Q2A



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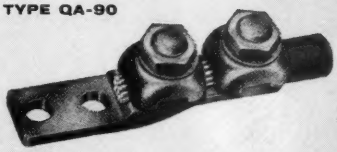

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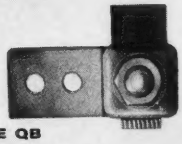
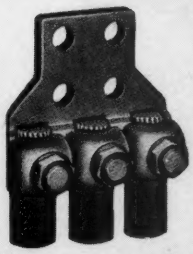


TYPE QB



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Patents

Some new ideas win protection in Canada

A METHOD for lacerating the tread of a rubber tire to increase traction was patented by Dominion Rubber Company, Ltd., Montreal. Invented by George V. Constantakis of Allen Park, Michigan, and described in Canadian Patent 524,515, the method involves holding a lacerating tool near but not touching the tread of the tire then rotating the tire so as to expand it radially by centrifugal force. This feeds the tread of the tire against the lacerating tool and lacerates the tread to the extent desired.

The laceration may be carried out while the tire is mounted on an automobile by jacking up the wheel. The amount of laceration can be controlled by stopping the operation when there is a marked increase in the pitch of the hum caused by the operation.

• • •

Stronger, tougher iron castings

CHILL-HARDENED iron castings of exceptional toughness and tensile strength are said to be produced by the process covered by Canadian Patent 524,385, issued May 1, 1956 to Benton Dixon of Toronto. The process uses magnesium-containing iron, and involves a special heat treatment after the casting has cooled.

The heat treatment, carried out at a temperature between 900 deg F and 1300 deg F for a period from 1 to 24 hours, spheroidizes the pearlitic structure in the body of the casting without reducing the hardness of the chilled zone. Iron containing .023% to .20% magnesium and not over 2% silicon is used, and the Brinell hardness of the chilled zone is maintained above 300.

• • •

Canadian invented clothespin

A DOUBLE-ENDED clothespin with a novel spring action was patented on April 10, 1956 by Canadian inventor Louise M. G. Olivier of Hull, Que. As described in Canadian Patent 523,618, the clothespin has a leaf spring with a reverse curve at each end that extends through openings in a rigid platform. The middle of the spring rests on one side of the platform and the free ends pass through the openings and engage the ends of the platform on its other side. By pressing down on one of the bowed curves of the spring, either of the free ends is separated from the end of the platform to enable clothing or a clothes line to be inserted between the spring and the platform. Release of the pressure allows the spring to secure the article firmly.

A hook may be attached to the platform so that it can be suspended on a line and both ends used for clothes.

• • •

Improve cast-forged products

A NEW METHOD for producing cast-forged metal objects has been patented by Karl K. K. Krover, of Aarhus, Denmark. As described in Canadian Patent 524,412 issued May 1, 1956, the method involves pouring into a lower die the amount of metal that will be needed to form the article when the dies are closed, and then moving the dies toward one another at relatively high speed and low pressure to trap the metal between the dies. When the volume of the space between the dies is substantially equal to the volume of metal, and before the dies exert any substantial pressure on the metal, the closing movement of the dies is suddenly altered to a lower speed and a higher pressure. Thereafter, the closing movement is continued at the lower speed and higher pressure until it is finally halted by the resistance of the metal.

• • •

Stencils for electric circuits

A STENCIL for printing an electric circuit on a support is covered by Canadian Patent 523,968 issued April 17, 1956 to Erie Resistor Corporation of Erie, Pennsylvania.

Invented by Jerome D. Heibel, of Erie, the stencil has openings defining cavities of the same shape as the element of the circuit to be printed. These can be filled with paint having the proper electrical properties. The stencil is covered with an upper platen with a valve that can be moved to one position to allow the paint to be injected into the cavities and to another position to vent the cavities to the atmosphere. Thus the injection openings can be closed with the platen removed without creating suction that would lift the paint from the base.

• • •

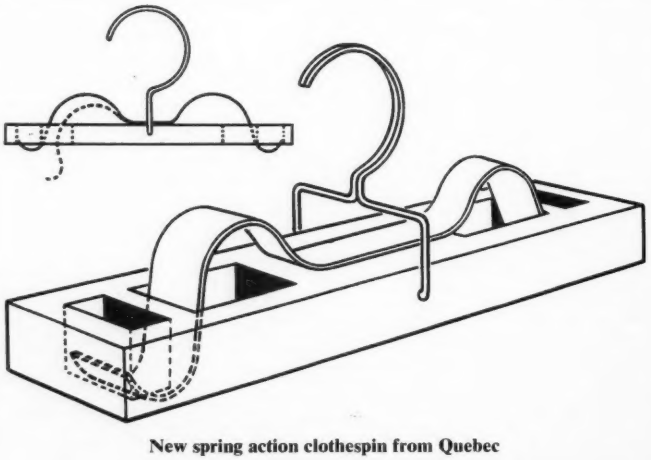
Extinguish fire with fog

A NOZZLE for producing fire extinguishing fog has been patented in Canada by Fog Nozzle Company of Los Angeles.

The patent features a particular arrangement of the openings in the wall of the nozzle, which is cone-shaped and has several openings. In each set there are three openings, with the axes of two of them arranged to intersect each other outside the nozzle, and the axis of the third directed to one side of this point of intersection.

The critical feature is that the axis of the third opening shall be no farther from the point of intersection than twice the diameter of the third opening and also no farther removed than the sum of the diameters of the first two openings. This means that the stream of water thrown out of the third opening misses the central point where the other two streams strike each other, and only strikes the outside of the column of water formed after they have joined.

The inventors are Thompson W. Burnam, of Whittier, Calif., and George B. Ramsay, of San Marino, Calif.



New spring action clothespin from Quebec

Here's the modern way to end lubrication troubles —install Farval

FARVAL—
Studies in Centralized Lubrication
No. 163

WHAT if your oiler uses the wrong oil or grease? Or maybe he's in a hurry and forgets a few bearings. Whatever the error, bearings may be ruined. A machine is down and expenses begin. All such troubles can be avoided by installing Farval Centralized Lubrication.

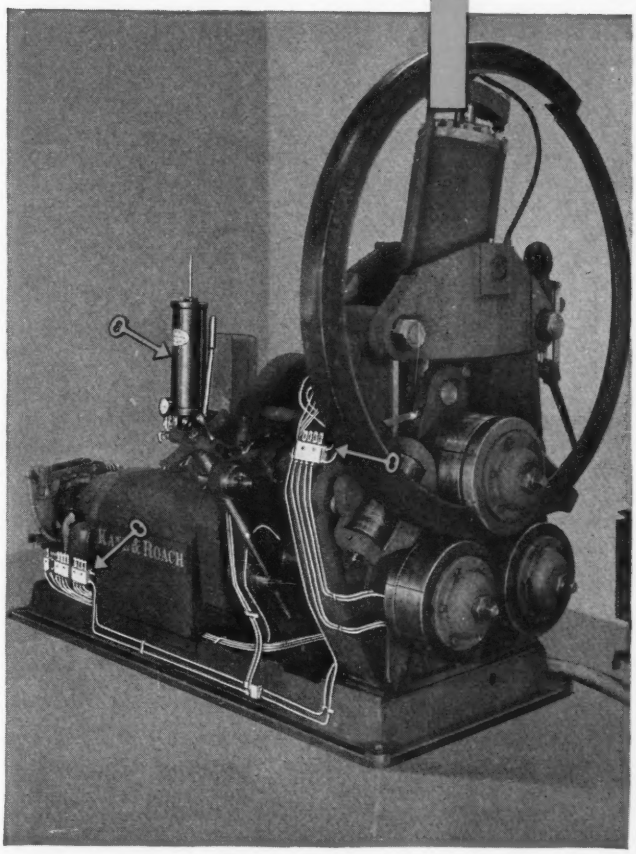
With Farval a measured amount of the *right* lubricant is hydraulically delivered whenever needed to the bearings of a machine. *No bearings are ever missed!* A "tell-tale" indicator at each bearing gives *positive proof* that the measuring valve has functioned and that the bearing has received the lubricant it needs.

Kane & Roach Installs Farval

This Kane & Roach Vertical Angle Bender is an excellent example of how one modern machinery builder protects his equipment from "human" error. According to this builder, the cost of just *one* shutdown due to haphazard lubrication would exceed the entire cost of its protective Farval system. With Farval installed, this machine can perform efficiently, with no danger of bearing failure. In addition, Farval saves oiling labor and lubricant!

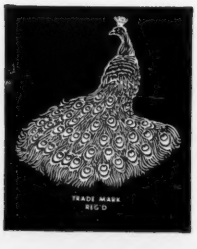
Free Lubrication Survey

Why not let us send a Peacock engineer to inspect your plant equipment? Without obligation, he will present a written analysis of how Farval can end your lubrication troubles. Write also for Bulletin 26 for the complete Farval story. Peacock Brothers Limited, P.O. Box 1040, Montreal 3, Que.



KEYS TO ADEQUATE LUBRICATION—**Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.**

Pictured is a *Farvalized* Kane & Roach Vertical Angle Bender (Model 23) used for bending angles, channels, rounds, squares and other shapes.



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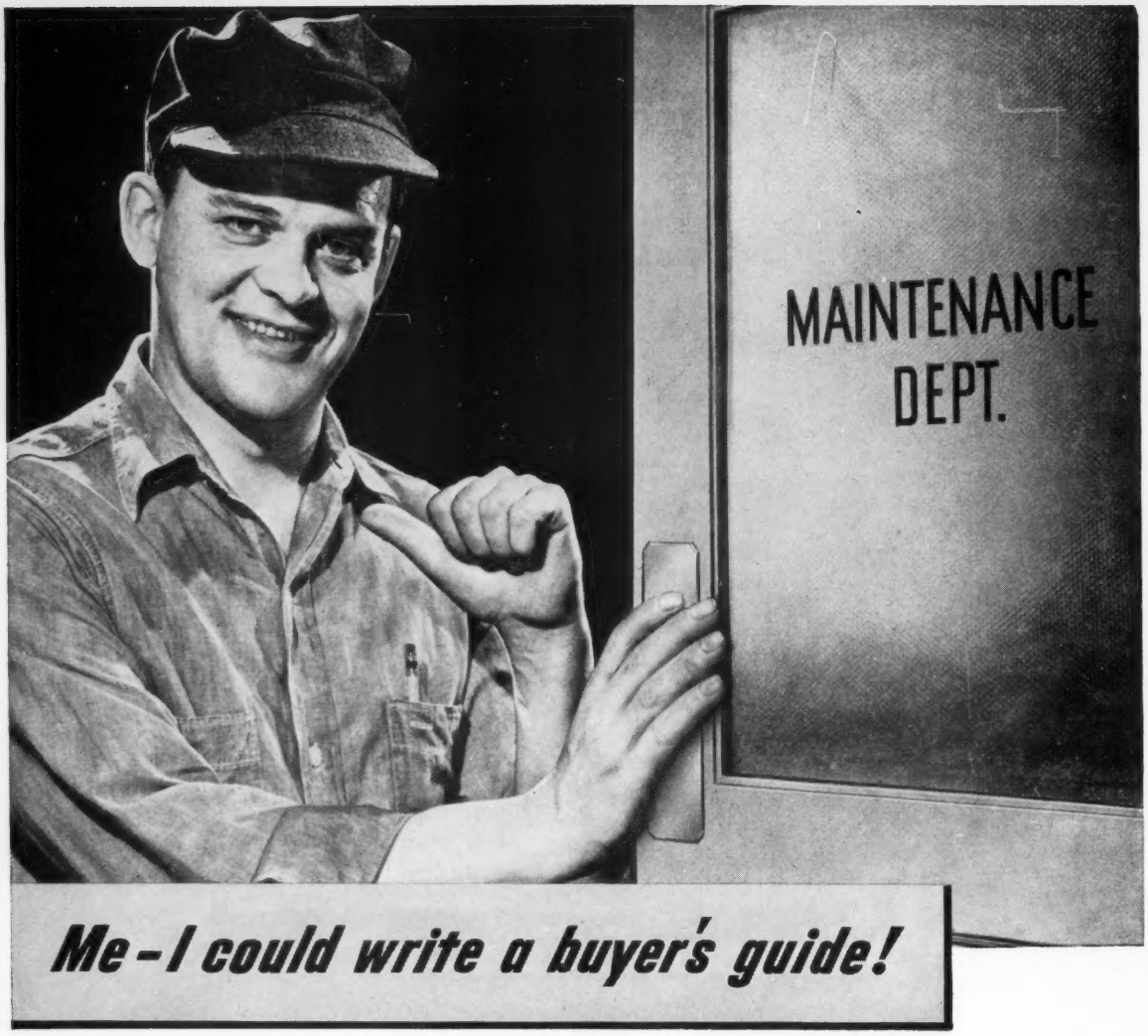

Me—I could write a buyer's guide!

WHEN IT COMES to equipment, you can't fool maintenance men. They know what stands the gaff—and what doesn't. They also know a lot of their work is due to faulty selection of equipment—mistakes in judgment of quality, mainly.

In buying valves, such mistakes usually happen when someone buys on price alone, or because "all valves look alike". In either case, today's penalty is excessive maintenance at the highest labor rates in history. And where valve trouble causes production loss, it, too, was never costlier.

Standardizing on Crane valves eliminates a lot of mistakes, and it's the thriftiest habit in piping equipment buying. Better Crane quality and bigger selection assure it.

For complete information on the Crane Valves to meet your particular requirements, ask your Crane representative, or Crane Branch—or write:

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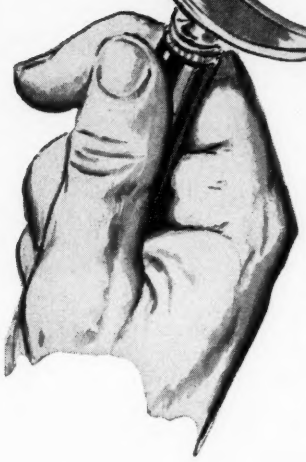

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Wilkinson Company Limited, Vancouver and Edmonton, in British Columbia, and Alberta

File

New booklets and books written for you

A QUICK-REFERENCE guide to 17 different lines of air-control valves and accessories has been published by AIR-MATIC VALVE, INC.

This guide should prove very helpful for the quick, easy selection by the designer of the company's right valve. (208)

• • •

New inert seals for all acids

A COMPLETE line of chemically inert mechanical seals, for handling all types of acids, corrosives, solvents and gases, is described in a new 8-page illustrated technical bulletin from CRANE PACKING CO. The bulletin provides construction, service and application information, including representative installations.

The mechanical seals described are of the John Crane Type. These seals incorporate sealing members fabricated from Du Pont Teflon to ensure positive resistance to all chemical attack. Metallurgical construction is governed by the service specifications. They can be used over a wide range of temperature conditions from —120 deg F to +500 deg F and pressures up to 750 psi. Precision-lapped, reversible seats provide materially increased service life.

One type of seal is especially recommended for chemical, petrol-chemical and refinery services. They are available in a full range of styles and sizes for all types of rotary shaft equipment, such as centrifugal and rotary pumps, mixers, agitators and autoclaves. (209)

• • •

New things you can do with wheels

A NEW CATALOGUE has been published by the AMERICAN PULLEY CO. called "Industrial Wheels." The four-page folder describes design and construction features of the company's line of 128 different Steelite wheel combinations, as well as semi-steel, pressed steel and semi-pneumatic wheels. (210)

• • •

Reach the buyer this new way

THERE IS a revolutionary way to attach a consumer message to the outside of a product container, according to a bulletin published by the PFAUDLER COMPANY.

The latest instructions, product uses, coupons, contest rules, can all be outserted on the package where it is in plain sight and sure to be taken home by the buyer. The outserting job is done quickly and automatically by a machine that will fit right into the production line.

In the past, outserting was limited by the high labor costs of hand operation and the hit-or-miss location of the outfold on the container, which often obliterated the brand name and trademark. Many concerns have not been able to use outserts because they could not afford to slow down their production lines. However, the company's Outsert Applicator solves all the problems that limited outserting—through quick, economical application of the sales message precisely where it belongs on the package. (211)

• • •

Ferromagnetic plastics described

A NEW SET of bulletins issued by POLYPENCO, INC., describe ferromagnetic plastic materials, both in flexible rod and tape and rigid powdered iron cores. The advantageous physical and magnetic properties are presented in graph form.

Trademarked Ferrotron, the new materials are characterized by temperature stability of 200 C, moisture stability at 100% room humidity, high impact strength, good machinability, high volume resistivity and high Q.

Flexible rod and tape forms allow good use to be made of the inherent magnetic properties and so make possible the design of smaller and more efficient electronic components. (212)

• • •

Metal finishing standards

A NEW 12-PAGE reference booklet, Metal Finishing Standards, is offered free by THE ALLEN MANUFACTURING COMPANY. This new booklet covers the plating and surface treatment of their products.

The first section of the booklet is devoted to general facts on metal finishing, with a discussion of the various types of finish, thread fits, formulas for calculating thread size before plating, quality requirements, hydrogen embrittlement, and protective handling and packaging methods.

The second section, arranged in easy-reference table form, covers various types of plating, with a clear statement of the advantages and limitations, applications, specifications and appearance of each type. The third section is a tabular summary of the various types of surface treatment. A corrosion resistance table follows, and then an outline of test methods. A section on stainless steel brings the booklet to an end. (213)

Book Department

Analysis of Electric Circuits

THE SIX BASIC physical laws established by early experimenters are first given by the author, WILLIAM H. MIDDENDORF. He then shows that it is only necessary to learn the full meaning of these six laws, and apply them with the aid of complex algebra, in order to advance to the present state of our knowledge.

Basing his presentation on successful experience in his own classroom, Professor Middendorf treats only those topics most essential to a basic understanding. These basic concepts are presented in detail and are accompanied by a variety of numerical examples and problems. Each article and chapter leads on to the next so naturally that the book becomes an interesting story of circuit analysis rather than a dry collection of facts.

The emphasis is on developing the reader's ability to think for himself. The examples and problems are designed to challenge and prod him in this direction. Proofs, rather than mere presentation, are accented.

The book is conveniently arranged into three sections. The first section provides all that is necessary to meet the problems encountered in the usual undergraduate course. The last two sections extend the scope of the work for electrical engineering majors. A feature unusual in a book of this kind is the inclusion of a valuable chapter on communication circuits.

The book is published by John Wiley, at 6 dollars.

• • •

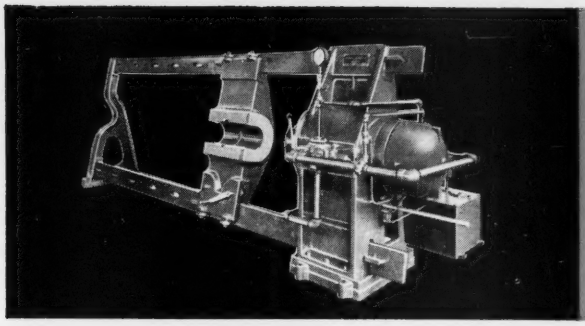
Electronic Engineering

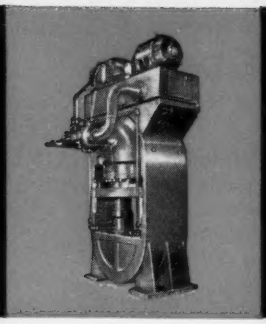
The book deals with a large variety of electronic circuits, important in such diverse fields as radar, television, electronic control, instrumentation and computers. After a general introduction on tubes and tube circuit principles the author, SAMUEL SEELY, PH.D considers the more important electron tube circuits. Emphasis is put on physical and mathematical analysis.

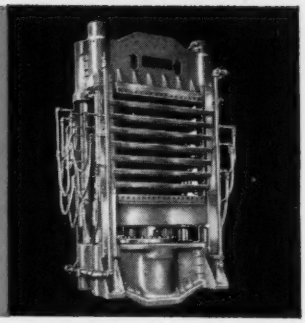
In any analysis care has been taken to include reference conditions for potential polarities, current directions and transformer-winding sense. Although most of the text is devoted to the analysis of circuit operation, some of the factors that must be considered in circuit and system synthesis are also discussed.

Because one of the purposes of the book is to train the reader in techniques of analysis, occasional alternate methods of a given circuit are included and varied analytical methods are employed in developing the material. Examples and problems are used to bring theoretical developments in line with practical situations.

The book is published by McGraw-Hill (Canada) Ltd. and priced at $9.60.







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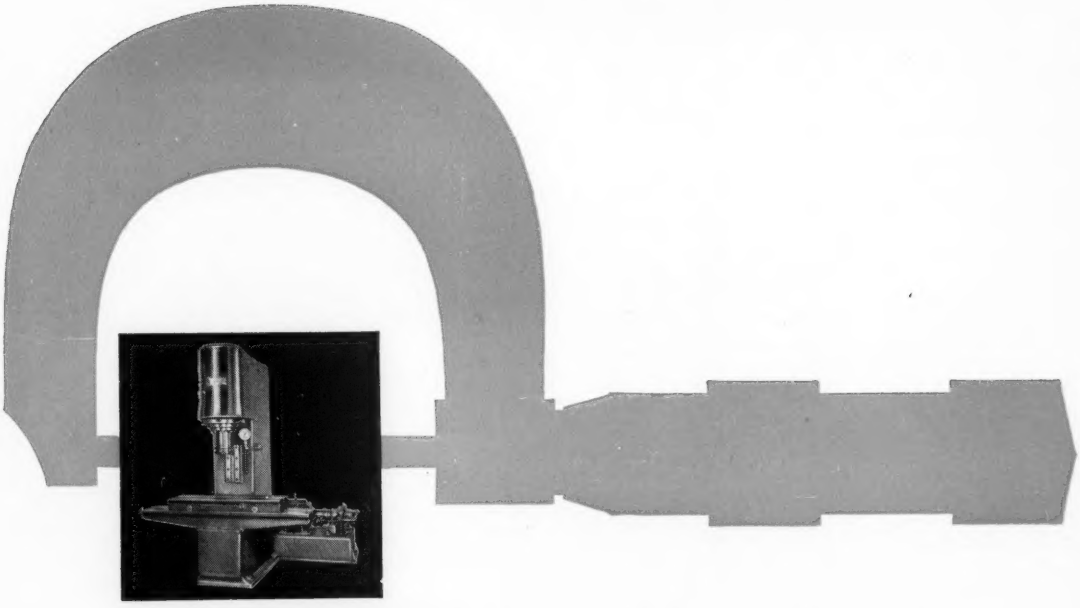

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Quotes

Points from current papers and speeches

A PAPER ON THE SUBJECT of machining with silent sound was recently given by Jack Welch before the AMERICAN SOCIETY OF TOOL ENGINEERS.

The paper covered four stages. First, the history of silent sound machining; second, the equipment required to operate the process; third, the present practical field of application; fourth, the future of machining with sound waves.

It was all started by physicist Dr. Louis Balamuth, a professor associated with New York City College. During one of his experiments to disperse solids in liquids (in this case, silicon carbide in water or mineral oil), he built up a small magnetostrictive transducer and hung it inside a beaker of fluid. His subsequent experiments proved that the nickel tube would cut a hole in the glass when it contacted the beaker in this suspension of water and silicon carbide. Dr. Balamuth was quick to realize that the outcome of this experiment meant a new concept in the removing of material; conductive or nonconductive, metallic or nonmetallic.

After many months of effort, the act of cutting materials by use of a sound wave had been somewhat perfected. Nation-wide publicity was given to his achievement. And, like the man who had built a better mousetrap, the world began to beat a path to the door of Dr. Balamuth. Some of those who came were sincere individuals trying to see if this new process would answer some of their problems. Others were just curious. Ultrasonic machines were built and sold and Shefflield was one of the first to try one commercially. In due course, Sheffield secured the sole rights to manufacture and market the Cavitron Ultrasonic Machine Tool to the industrial field.

• • •

Cypak controls discussed

CYPAK CONTROL SYSTEMS was the subject of a lecture by T. C. Finnell at the 20th Westinghouse annual MACHINE TOOL ELECTRIFICATION FORUM.

Many of the applications quoted already have an impressive record of performance to give proof that Cypak has come of age and is known to be a stable, reliable contactless control system. Other control systems are on the job, ready to begin their service.

One of the major questions that was raised when the method was first announced in 1955 concerned its cost, particularly as compared with that of conventional control systems. This is a very natural inquiry, one which is faced by all pioneers of new products, new methods, new ideas. All of us in industry have faced it many times. The automobile, the refrigerator, radio, television, and air conditioning—all these have gone through such periods of acceptance and growth until the recognition of their value was established. During these periods improved techniques of manufacture and continual improvement in the product have steadily reduced the initial cost of the product. And so it is with Cypak. Just as surely as these great achievements have become a part of our living, so will it take its place as a highly valued means of getting greater value from automatic control systems. It will be established as a good investment that will pay its way.

Now let us look at where we stand today on this matter of cost. First, what is meant by cost? To many, the term means only initial cost. Last year we said that the cost of a Cypak system would be greater than that of the conventional approach, but that this differential would vary depending on the functions the control must perform. Since that announcement, marked improvements in both components and their assembly have contributed to a reduction in this differential. This will continue as we work with more applications and our volume increases. Our ultimate objective is still to meet or to beat the initial cost of conventional systems. We have not achieved this objective yet, but we are definitely on the way to success.

• • •

Axial flow pump, new theories

THE PERFORMANCE OF an axial flow pump is dealt with by E. A. Spencer in the CHARTERED MECHANICAL ENGINEER for April.

This type of pump is used where large quantities of liquid are required at relatively low heads. The tendency in earlier designs was to base the blading angles on the theoretical velocity triangles obtained from the simple Euler theory. About thirty years ago, however, aerodynamic theories on the behaviour of an aerofoil in a stream began to be applied to this type of pump. This modified theory, described, for example, by O'Brien, Folsom and Patterson, was used as the basis for the design of a set of free-vortex impeller blades for the present investigation.

An 11 inch diameter experimental pump, in a self-contained open circuit, was driven by a 25-hp electric dynamometer over a speed range of 1,050 to 1,400 rpm. The hub diameter was 6 inches, giving a hub/tip ratio of 0.56. At the design flow of 6 cusec. and 1,300 rpm, the calculated head, based on the mean axial velocity in front of the four-bladed impeller, was 16 ft. This gave a specific speed of 7,700 which is below the optimum normally used for pump designs. The blade chord length was approximately 5 in., an RAF-6 aerofoil section being used. The blade angle varied from 13 deg to 31 deg between tip and hub. Inlet guide blades were used to ensure good entry conditions and the whirl velocity created by the impeller was converted to static pressure energy in six straightener blades.

• • •

Better vibration measurement

DETAILS OF A NEW vibration meter with a self-contained power source, which can be carried and used anywhere to measure the amplitude of vibrations in the 10 to 1,000 cps frequency range, are given in CEC RECORDINGS for March-April.

The new instrument is an all-transistor, etched-circuit design. It adds new flexibility to the techniques of tracking down and measuring mechanical vibration.

Portability of vibration-measuring equipment is of prime importance in such situations as pre-flight jet-engine run-ups, machine-shop operation and mobile testing. In these applications a lightweight battery-operated device, simple to operate and producing direct, unambiguous readings, is particularly convenient. The 1-128 was designed to meet these requirements, and also to operate under the rather severe environmental conditions frequently encountered in such applications. For example, circuit design and component selection were based on an expected temperature range of —20 to +120 deg. F.

Because the environment can be expected to have fairly high sound levels, microphonic elements cannot be tolerated. The use of transistors did away with the problem of microphonics, and also eliminated the need for long warm-up periods before the instrument could be put into operation.

The circuit lends itself particularly well to etched wiring. Use of a two-sided etched board was dictated by the need for compact design. All electronic components, including the meter, are mounted to the etched board, which is in turn assembled to the upper half of the die-cast case.

The meter includes a number of design features which will be appreciated by engineers.

Standard CEC self-generating pickups can be used with the meter to sense vibration, indicated directly on the large, easily read dial as mils peak-to-peak displacement. For maximum convenience, simplified operating instructions are printed right on the case.

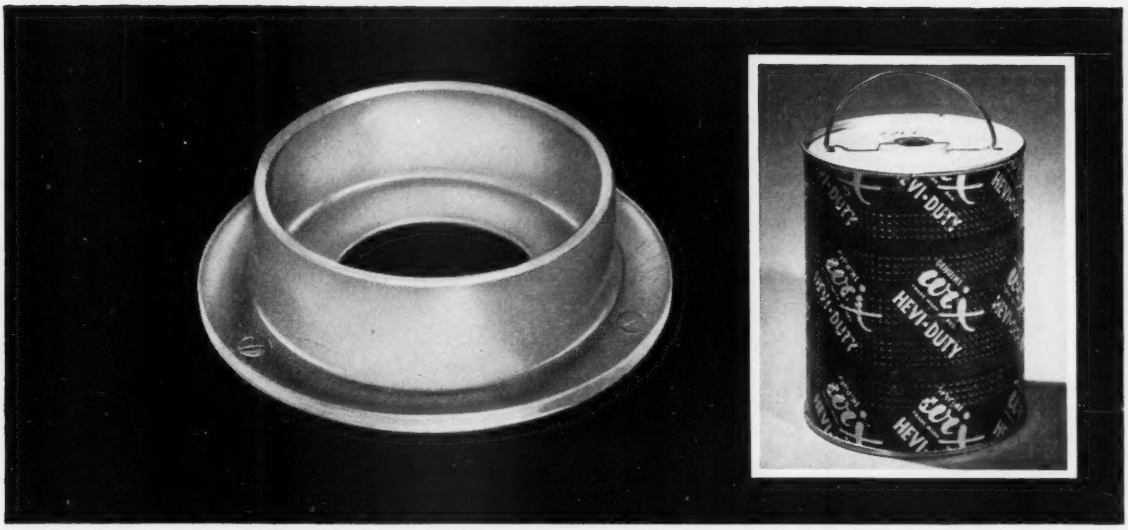
DUPONT CANADA

PRODUCT ENGINEERING NEWS

PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

"ZYTEL"* nylon resin chosen for a Filter Seal

"Wix" oil filter shows how an outstanding material and good design improves quality at no increase in cost.



Simple nylon moulding gives better seal, longer life and simplifies assembly of famous "Wix" oil filter cartridges. Moulded for Wix Accessories Limited by Smith & Stone Limited, 50 St. Clair Avenue West, Toronto 5, Ontario.

Here is a development typical of a great many product improvements brought about through the use of "Zytel" nylon resin when good design is used.

The seal on the "Wix" oil filter must be stable and remain tight under operating temperature ranging from 40° or 50° below zero to 200° or more above zero, to say nothing of resisting degradation due to exposure to standard motor oils at these temperatures.

Originally the seal was a three part laminate of fibre, steel and rubber which required two assembly operations to install. Applying its knowledge of the properties of nylon to the job required, "Smith & Stone" is now moulding this one-piece part which provides tangible savings in cost and a most efficient seal. Testing indicates to "Wix" that it will far outlast the life of the filter. "Wix" now confidently advertises that no oil can by-pass "Wix" Nylon Seals. These seals will not soften in use under any condition — will retain their exact size and shape. In actual service for nearly three years, these seals have exhibited no sign of failure.

OVER

The protective shield of "Lucite" acrylic resin on this Kalart flash attachment was molded by T. F. Butterfield, Inc., Naugatuck, Connecticut.

Crystal-clear safety shield of LUCITE* protects against flashbulb shatter

BECAUSE it is transparent and durable, "Lucite" acrylic resin offers outstanding advantages. Its high impact strength and weather resistance afford long wear and heavy-duty service. "Lucite" gives optimum transparency and can be colored to provide unusual decorative effects.

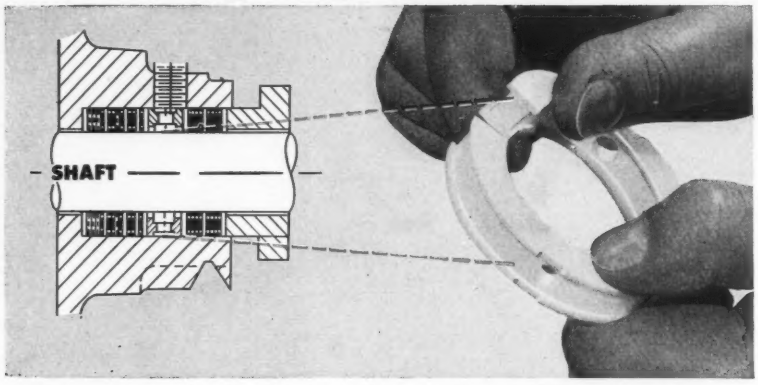
An interesting application of this engineering material is in the new Kalart flash attachment. "Lucite" is used for a safety shield protecting subjects from possible shatter of flashbulbs. Economically molded, "Lucite" withstands heat without discoloring.

DU PONT CANADA

PRODUCT ENGINEERING NEWS

PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

Du Pont TEFLON* for flexible seal cages which snap in place easily, won't score shaft



Effective sealing without danger to the shaft is possible with seal cages of "Teflon". These flexible cages snap on and off quickly and give long wear under rugged conditions. (Manufactured by Chemical and Power Products, Inc., New York, New York.)

"Teflon" is strong and chemically inert through a wide temperature range

THESE flexible seal cages of Du Pont "Teflon" tetrafluoroethylene resin supply annular space in packing for lubrication with oil or grease, or for cooling. Users of pumps and other process equipment will appreciate how quickly and easily these flexible seal cages of "Teflon" snap on and off a shaft. They're tough—won't bend or collapse under extreme gland pressure. Yet, because "Teflon" is non-adhesive, there's no danger of a scored shaft or sleeve from these seal cages.

"Teflon" is used extensively in chemical, electrical and mechanical applications. Its chemical inertness, high heat resistance ("Teflon" operates in many applications at temperatures as high as 500°F.), low temperature toughness, and low coefficient of friction make this engineering material particularly adaptable to severe service conditions. Possibly "Teflon" can solve an engineering problem for *you*.

Shield of ALATHON* solves insulation problem in new RCA Victor color TV receiver

THE PICTURE TUBE in the new RCA Victor color television receiver operates at 25,000 volts. To provide insulation for this tube, RCA engineers needed a material that could be readily and inexpensively molded into the complex shape of a kinescope shield . . . yet had high dielectric strength. Du Pont "Alathon" polyethylene resin proved to be an ideal material for the shield on all counts. In addition to providing the needed insulation, the shield of "Alathon" gives mechanical protection to the tube when it is shipped or handled.

"Alathon" not only has excellent insulating properties but is strong, lightweight and

flexible. It is chemical resistant, as well as odorless, tasteless and non-toxic. Because of these properties, and the ease with which parts can be molded, extruded or fabricated, "Alathon" has helped engineers solve many design and operating problems.

DU PONT COMPANY OF CANADA LIMITED, DE-6
CHEMICALS DEPARTMENT, Room A-4, P.O. Box 660, MONTREAL, QUE.

Please send me more information on the Du Pont engineering materials checked: ☐ *"Zytel";* ☐ *"Alathon";* ☐ *"Teflon";* ☐ *"Lucite". I am interested in evaluating these materials for:*

NAME_____ POSITION_____

COMPANY_____

STREET_____

CITY_____ PROVINCE_____

TYPE OF BUSINESS_____

*"Alathon" "Lucite" "Teflon" and "Zytel" are registered trade-marks of E. I. du Pont de Nemours & Co. (Inc.)

Investigate DuPont engineering materials in your product development programs

One of the family of these versatile engineering materials is often a key factor in product improvement or new product design. The wide range of properties, available with "Alathon"* polyethylene resin, "Lucite"* acrylic resin, "Teflon"* tetrafluoroethylene resin, and "Zytel"* nylon resin, are helping solve industrial design problems.

NEED MORE INFORMATION? Clip the coupon for additional data on the properties and application of these Du Pont engineering materials.

Letters

Readers' viewpoints . . .

● You have been kind enough in the past to let us use articles from DESIGN ENGINEERING for reproduction in Mechanix Digest — house organ of Joseph Robb Co. Limited.

In your March 1956 issue was an article, "How near is the gas turbine car?" by P. E. Biggar.

May we have permission to use this article—and also may we reproduce the diagram (page 28)?

NORMAN CHAPPELL
McConnell, Eastman Company
Montreal

Permission happily granted.—Ed.

This creativity business . . .

● I was delighted to read in your May issue your report on a meeting which had been held on April 12 to discuss the problem of "creativity in design."

I would be most happy if you would arrange to put me in touch with the organizers of the meeting which is now proposed.

J. S. L. KING
Toronto *Consulting Engineer*

● With reference to the article, "Are we losing our industries . . ." (DESIGN ENGINEERING, May)—I would appreciate it very much if I could be put in touch with the organizers of the coming meeting.

F. SZTUKE
Outboard Marine and Mfg. Company
Peterborough, Ont.

All readers responded to DESIGN ENGINEERING's offer to pass names to the "creative engineering" movement have been put in touch with the organizers. The offer is still open and the editors will be happy to pass along any more names that come in.—Ed.

● We were extremely interested to read the article in your May issue of DESIGN ENGINEERING, "Are we losing our industries . . ."

We would be pleased if you could forward our company name along to the individuals interested in pursuing the subject of creativity in industry.

W. C. BLACK
Montreal *Sperry Gyroscope Company*

The organizers of the "creative engineering" group explain that the idea

is to win the interest of individual graduate engineers. At this stage they do not see that corporate interest, although very encouraging, could be put to much use. They hope to hear that Sperry engineers will individually take their interest in the idea farther.—Ed.

● I was very interested to read about the anxieties being expressed by the newly formed group of engineers concerned with creative engineering in Canada (DESIGN ENGINEERING, May).

At a recent meeting of the Association of Canadian Industrial Designers our members were debating what could be done about the very same problem—the growing control of Canadian industry from outside our borders which they find is encroaching into ever more fields as the time goes by.

It is not unusual in the course of our contacts with manufacturers in Canada to come up against a stone wall that all decisions on product design and development have to be referred to a parent or associate company south of the border—and for this reason many promising Canadian industrial designers move south where such decisions have to be worked out.

In our instance we decided that there was another reason for this dependence on the U. S.—that Canadian manufacturers who do not have these bonds still tend automatically to look abroad for design leadership and ignore competent industrial designers within their own borders. To this we felt that the solution was for more publicity for the good design work being done in this country by Canadian designers and engineers.

We wish that there was as simple an answer to the first problem.

JOHN ENSOR
Toronto *President, A.C.I.D.*

• • •

Canadian industrial designers have for long grappled with the problem of how to win fuller recognition for their talents. Perhaps the new "creative engineering" group, if it is officially formed, will give strong support to this worth while campaign — which is part of an industry-wide search for fuller independence.—Ed.

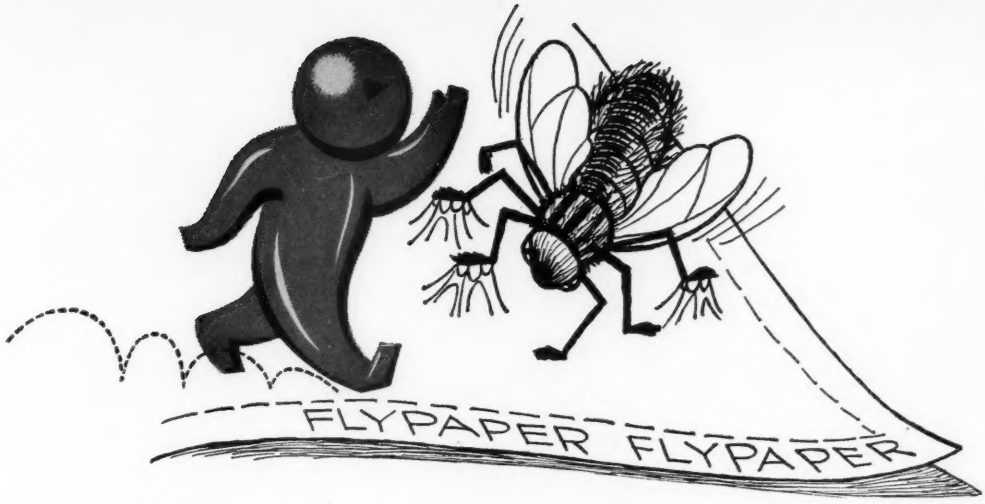
Information please

●In the October 1955 issue of DESIGN ENGINEERING, there was an article "Ultrasonic processing in industry" by F. Rose, an industrial consultant.

Could you please tell me where we could obtain more information

C. R. HENDERSON
Western Plywood Co. Limited
Vancouver

Full information has been sent direct by ultrasonics expert Rose.—Ed.



In production work too— G-E Silicones prevent sticking...

Now, flies can't read . . . or understand English, either. This one didn't know about G-E Silicone Release Agents and was soon a dead duck . . . or fly. However, a large number of Canadian industries use G-E Silicones to solve many sticky problems. By keeping *things* from sticking together, G-E Silicones are speeding production, cutting costs and improving products. Don't you get stuck. Take the tip and learn more about these amazing release compounds.

For instance glass molders are using an especially designed G-E Silicone for releasing glass from molds. It gives a better surface finish, eliminates smoke and fumes and improves working conditions. It provides higher bursting strength, better mar resistance, cleaner molds, longer mold life and less maintenance.

Paper treated with G-E Silicone is used as anti-stick or anti-block sheets. It keeps raw rubber slabs, asphalts and resin products and many other materials from sticking together in production and packaging.

Another G-E Silicone Mold Release Agent used in making tires, fabricated parts, tiles and plastics give better release, better finish, fewer rejects and saves on mold-cleaning down-time.

SEND FOR FREE LITERATURE

In the revolutionary Shell Molding Process G-E Release Emulsion No. SM55 has made possible castings that do not have to be machined. The cured sand-resin shells are freed easily from metal patterns, to produce perfect reproductions everytime.

You owe it to yourself to know more about the many G-E Silicone Release Agents and how they can be used in your business.

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CANADIAN GENERAL ELECTRIC COMPANY LIMITED

DESIGN ENGINEERING's *artist's impression of the new sub taking off from water.*

U.S. expert foresees submarines that fly

For some years the U. S. Department of Defense has kept a security ban on details of a new "flying submarine" which may someday add its contribution to warfare.

But towards the end of last year, a patent covering the idea was granted to Donald B. Doolittle, vice-president engineering of the All American Engineering Company; and following the patent publication, some superficial information about the project has been released.

The machine uses two power plants. It has a jet engine with air intakes on the upper part of the fuselage for flying; and a marine engine driving a small propeller at the rear for underwater power. In flight the marine propeller is retracted inside the fuselage.

The craft lands and takes off on hydrolift landing gear (water skis to most people) which also retract in the air. The hydro lift gear has been credited by the inventor with holding the key to the success of the whole machine. The gear has been widely tested on several types of conventional aircraft and works very well.

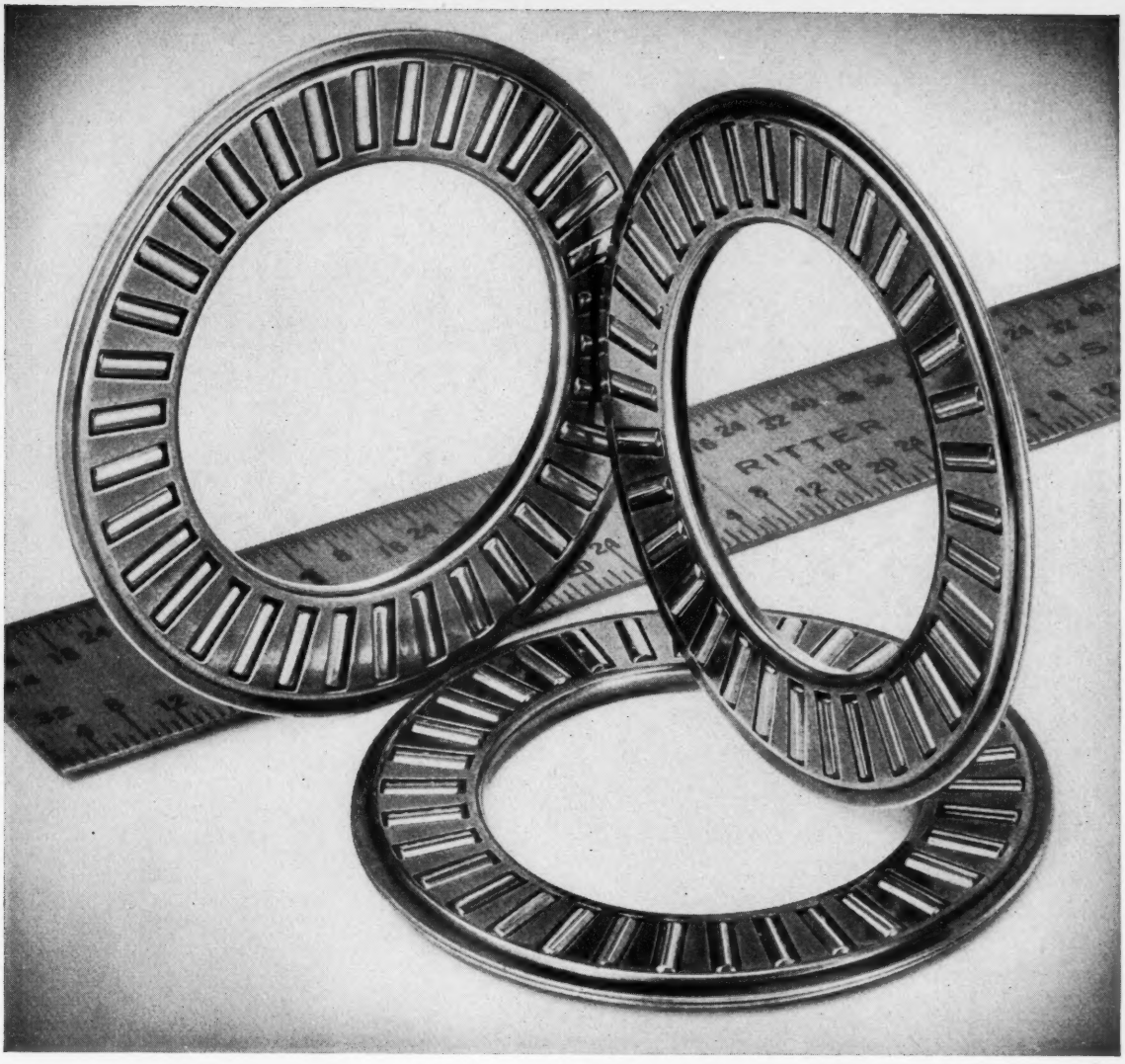
A brief account of how a pilot would go about landing, submerging, surfacing and taking off again, has been given.

The pilot starts the marine engine while still running in to land. After touching down on its skis, the craft aquaplanes until it slows enough for the skis to slide under water leaving the hull afloat. Then the jet engine is stopped, the air intakes and exhaust sealed and the cabin pressurization turned on. The craft is now all set to become a submarine.

Water ballast tanks are then filled, and the craft submerges to be driven under water by its marine engine and controlled by its airplane controls.

To surface, the pilot fills his tanks with compressed air. Once afloat again, he cuts his marine motor, pulls in the propeller, opens the air intakes and exhaust—and starts the jet. As the aircraft picks up speed, the skis lift it out of the water and at flying speed the craft climbs into the air.

How much "Jules Verne" and how much practical engineering is there in this project? "It seems spectacular," admits the inventor, "but it doesn't involve a change in any basic aerodynamic or hydrodynamic principle. Of course there are many problems still to be overcome but the only difference between flying in air and "flying" in water is one of density." ★



Here's the **NEW** Torrington Needle **THRUST** Bearing!

Now designers have available a *needle bearing* exclusively for heavy *thrust* loads.

This compact Torrington Needle Thrust Bearing—only .0781" in cross section—is no thicker than an ordinary thrust washer. Yet it brings all the advantages of anti-friction operation at low unit cost for many thrust applications.

Two mating retainer halves, highly accurate steel stampings, are securely joined to form a self-contained unit closed on OD and ID. The bearing can run directly on adjacent parts, hardened to act as races, or on economical hardened and ground flat races. The bearing is piloted on the retainer bore.

In any thrust application where low unit cost, high thrust capacity and compact design are primary factors, consider the Torrington Needle Thrust Bearing. Services of our Engineering Department are available to assist you with design and application.

Send for our new Bulletin, "No. 16—Torrington Needle Thrust Bearings," for full information.

Highly successful applications of the Torrington Needle Thrust Bearing have been made in automatic transmissions, governors, steering gears, bevel gears, hydraulic pumps, and torque converters.

THE TORRINGTON COMPANY LIMITED
925 Millwood Road, Toronto 17, Ont.

District offices and distributors in principal cities of United States and Canada

TORRINGTON BEARINGS

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

Tormag drives

(continued from page 51)

be reversed, the bar magnets would tend to drag the metal plate after them. So, it makes no difference whether the plate moves and drags the magnets, or the magnets move and drag the plate.

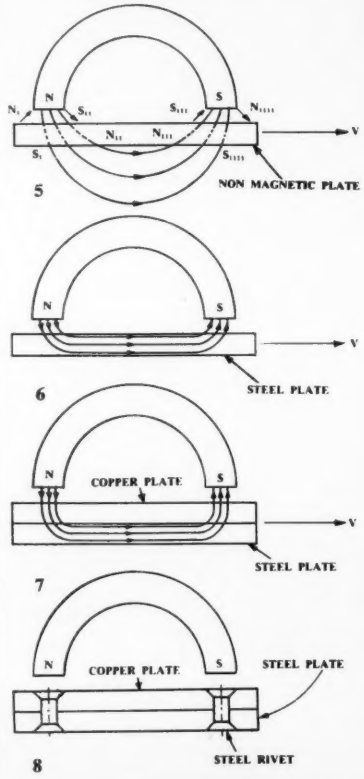
This is true only if the speed of motion, or the electrical conductivity of the metal plate, is so low that the eddy currents are weak and the magnetic field produced by the eddy currents is weak in comparison with the initial magnetic field.

Similar arguments applied to the horseshoe arrangement shown in diagrams 5 to 8 mean that a drag on the magnet due to attractions and repulsions will be created. The forces will be stronger as the induced pole strength increases. This depends on the eddy currents, which in turn depend on the electrical conductivity of the metal plate and of the electromotive forces induced in it. The electromotive force depends on the rate at which magnetic lines are cut—and this depends on the speed V and the number of lines present. A horseshoe magnet of given strength will produce a magnetic flux density in the neighborhood of its poles which depends on the reluctance of the magnetic circuit between the poles. The magnetic reluctance is reduced by eliminating non-magnetic materials (air, copper) and replacing them by soft iron or steel or any other material of high magnetic permeability.

So, if the metal plate is made of steel, the flux lines will have a tendency to run—as shown in diagram 6. If the air gaps are small, this will give low reluctance, high flux and large induced electromotive force. However, the poor electrical conductivity of steel will tend to reduce the eddy currents in spite of the increased electromotive force. To avoid this, the bi-metallic plate—see diagram 7—is used. The steel layer provides an easy path for the flux while the copper makes an easy path for the current. But the non-magnetic gap has increased by the thickness of the copper layer. Steel rivets — see diagram 8 — improve the situation.

These rivets decrease the non-magnetic gap, so increasing the flux, the emf and the drag. And besides this, they make a mechanical bond between the two unlike metals to check the effect of differential expansion. ★

The horseshoe arrangement:



When you demand high uniform quality, *you use Bonderite under the paint.*

PROTECTED BY Bonderite PARKER RUST PROOF CO. QUALITY CORROSION RESISTANT

SEAL WITH A MEANING

The red and silver Bonderite seal on your products will tell buyers, "This Product Will Look Better Longer," 25 years of national advertising backs up this seal. Write to find out how you can cash in on it.

● When you see the smooth, tight-grained, uniform Bonderite coating move past the inspection station, you know your final paint film will be smooth, even and lustrous.

There's another point to mention here. As production men know, when inspection finds high uniform quality on the paint line, there'll be mighty few field refinishing costs to bite into profits.

High uniform quality is just one of the advantages Bonderite delivers. Let us tell you the rest of the story. Write or call today.

**Bonderite, Bonderlube, Parco, Parco Lubrite, Parker Pre-Namel—Reg. U.S. Pat. Off.*

PARKER RUST PROOF COMPANY OF CANADA LTD.,
REXDALE BLVD., REXDALE (TORONTO), ONTARIO

Since 1914— leader in the field

BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

V-belt drives

(continued from page 60)

sheave. If one sheave in any drive is smaller than the other, it has less than 180 degree contact. The sheave will have less gripping area, and hence can transmit less power. The arc of contact correction formula shows the horsepower capacity retained by the belt. Each belt of a multiple drive will have this same percentage of horsepower effectiveness.

Arc of contact (deg.) $= 180 - \frac{60\,(D-d)}{C_1}$

$$= 180 - \frac{60 \times 14.6}{38.1} = 180 - 23 = 157$$

No, no operator! Mr. **Smit.** S. for selenium, M for molybdenum, I for iridium, T. for thorium . . .

Arc factor = .95 say

Corrected hp ratings are:—

Standard	= 8.0 x .95 = 7.6
High capacity	= 11.0 x .95 = 10.4

(e) **Belt length factor**

There is a compensating factor to consider on V-belt drives which must have a comparatively long centre distance. Long belts, theoretically, have longer life than short belts because there is more length of belt to wear. With the same amount of wear distributed throughout their greater length, long belts should last longer in service. In the modern system of V-belt-drive calculation, a belt length factor is used to reflect this relatively longer life.

From tables (not shown) for C128,

(Continued on page 92)

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DESIGN ENGINEERING

481 University Avenue,

Toronto, Ontario.

READER'S SERVICE DEPARTMENT

JUNE, 1956

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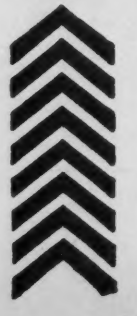

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• There is, of course, no charge and no obligation.

Wire thread inserts

(continued from page 39)

For quantities of up to 1,200 per hour, tooling consists merely of a Pip mandrel. The mandrel may be used in any device with a suitable stroke for pushing the insert into the hole such as a drill press, kick press, arbor press or air piston. Rotation is not required.

The Pip push insert is recommended for the entire family of plastics; zinc die castings, permanent mold and sand casting alloys; wrought, die cast and cast aluminum alloys; lead base castings alloys; soft copper base alloys; and ferrous metals under certain conditions. Like insert is manufactured from wire coiled into a helix. However, the Pip insert differs from the standard in several ways: (1) the Pip insert is tightly wound; (2) adjacent coils are in contact; (3) no driving tang is needed because the Pip insert is merely pushed into the hole; (4) whereas the standard insert has a diamond-shaped cross section, the Pip insert has flat surfaces where the coils are in contact so that axial pressure will not cause the coils to slip over each other. The internal threads are standard 60 degrees. The external angles are 90 degrees.

When the screw is turned into the threads provided by the insert, the thread run-out on the screw automatically wedges the top coil of the insert into the parent material which securely anchors it. In the case of light metals, a simple staking operation, consisting of upsetting the metal around the hole, may be used as an alternate method of anchoring. Simple tooling is available to stake the insert by the same stroke that installs it. The insert can also be installed from the back in the case of through holes to press against a retaining shoulder. The shoulder can be obtained by counterboring, step drilling, molding or die casting. ★

V-belt drives

(continued from page 87)

belt length factor=.98. Multiplying by the above hp ratings, standard rating= 7.4 hp; high capacity rating = 10.1 hp.

Number of Belts Required

(a) The actual hp required is found by multiplying the rated (nameplate) hp of motor by a service factor. From tables (not shown) this factor is 1.2. Hp required=25 x 1.2 = 30.

(b) Divide the actual hp required by the corrected hp of one belt

$$\frac{30}{7.4} = 4.05 \text{ for standard belt.}$$

$$\frac{30}{10.1} = 2.97 \text{ for high capacity belt.}$$

Drive Catalogue Number

A V-belt drive is usually written in one line as follows: the first number represents the quantity of V-belts required.

The following letter and number represent the size and length of the V-belt.

And the last numbers

The last two numbers show the pitch diameter of the driver and driven sheaves respectively in tenths of an inch. For a standard belt drive, the drive catalogue number equals 4—C128—94—240; for a high capacity belt, 3—CM128—94—240. Centre line distance equals 38.7 in. ★

Advertising index — June

Editorial

But where were the missing Canadians?

WITHOUT A DOUBT one of the most significant events for all design engineers this year was the first Design Engineering Show and Conference, held last month in Philadelphia.

And yet, out of an attendance of more than 13,000 visitors (far and away above the number expected) a mere handful of Canadians turned up.

Why was this? Was it apathy? Or just ignorance of the fact that the show was being held? There should not have been ignorance — DESIGN ENGINEERING announced the event in three successive issues—and in April carried a special invitation. It was there to help readers bypass the formalities and get into the show as fast as possible.

Canadian engineers should know what a good thing they missed. Everyone who went along has been loud in praise, has felt that it was time well spent.

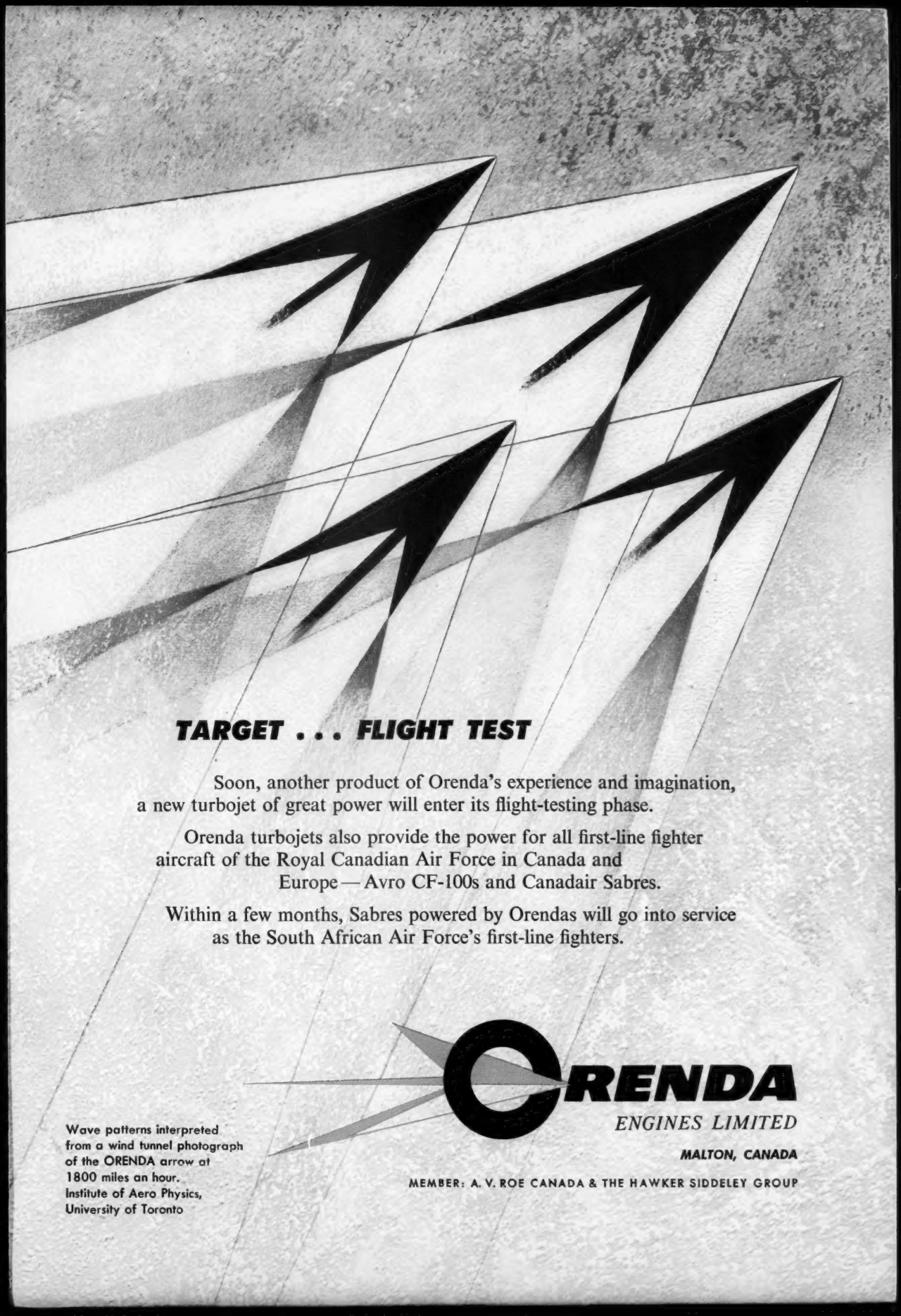
Organized by Clapp and Poliak, the theme was "Tomorrow's products are tomorrow's markets." The 175 booths in the exhibition covered the four categories of materials, methods, finishes and component parts—the same categories covered by DESIGN ENGINEERING. Topics at the conference (sponsored by the American Society of Mechanical Engineers) included panel sessions on value analysis in product design and how to get, train and keep design engineers. And there were sessions on how to select materials for products and how to recognize and reward inventiveness.

Show organizer Saul Poliak was delighted with the success of his labors. "Design engineering," he said, as he watched the multitude of industry's experts gather in the Convention Hall, "is the key to new markets. Cheaper manufacturing processes, new, maintenance-free components, better materials and finishes with greater strength and longer life—these are the concern of design engineers." And these, he might have added, are also the concern of nations. For the design engineer is as responsible as anyone, and more responsible than most, for the safety and prosperity of his country's future.

So, where were the Canadians? Canada has much to learn, if she is to hope for independence. American engineers, filled with the energy and ambition that has taken that country so far, massed into the show. Some were reported to have flown great distances to attend for just a few hours. But Canadians stayed at home. If Canada is too short of time for this sort of thing, it is a safe bet that the time is coming when she will be too short of everything.

At least there is now the promise that a second show will be held next year. Booths have already been reserved and the organizers are hard at work for a repeat success—this time in New York.

Canadian engineers should plan now, with 12 months to do it in, to attend the show. Maybe next year, this wonderful opportunity to learn will not be lost.



TARGET . . . FLIGHT TEST

Soon, another product of Orenda's experience and imagination, a new turbojet of great power will enter its flight-testing phase.

Orenda turbojets also provide the power for all first-line fighter aircraft of the Royal Canadian Air Force in Canada and Europe — Avro CF-100s and Canadair Sabres.

Within a few months, Sabres powered by Orendas will go into service as the South African Air Force's first-line fighters.

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MALTON, CANADA

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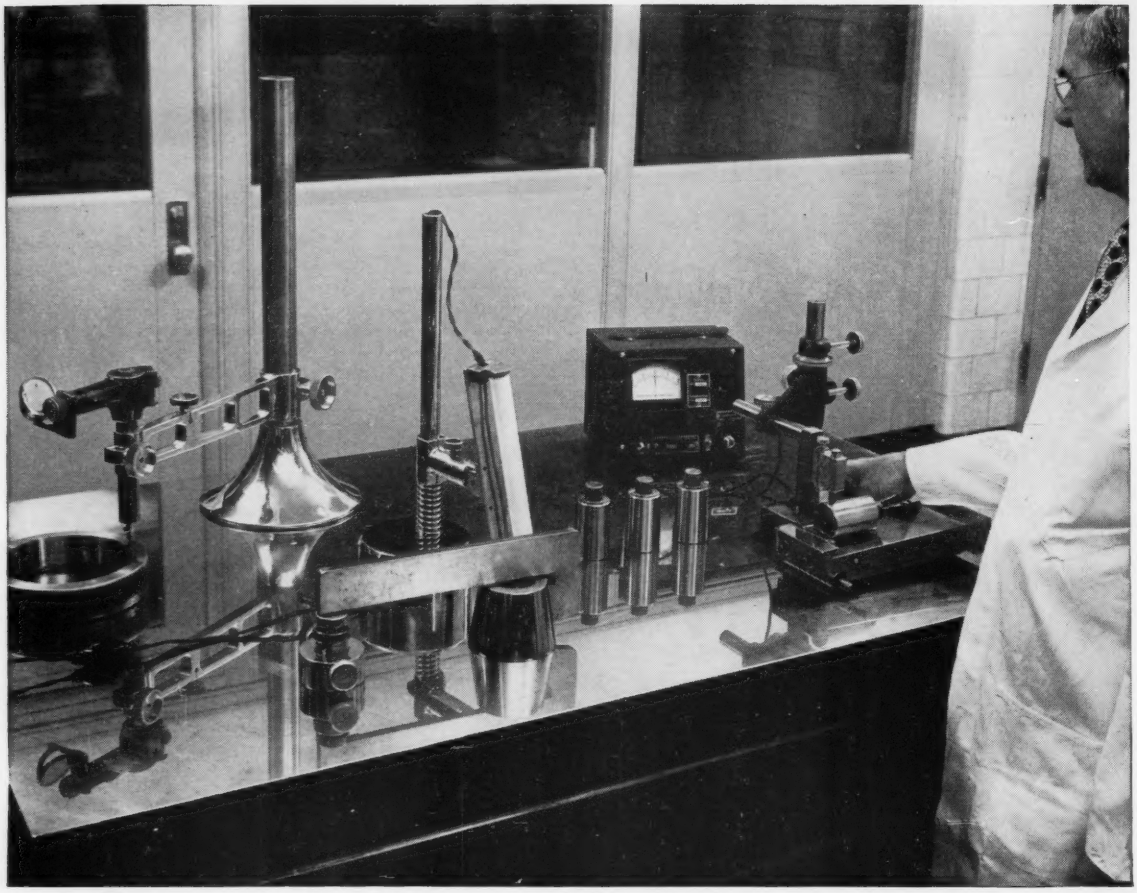
Wave patterns interpreted from a wind tunnel photograph of the ORENDA arrow at 1800 miles an hour. Institute of Aero Physics, University of Toronto



How you can profit from a nation-wide search for accuracy

SCIENTISTS at the Massachusetts Institute of Technology were stymied on a top secret National Defense project. Some extremely accurate plug and ring gages were needed, but where to find a manufacturer capable of tackling an order calling for such extreme accuracy was the problem. The search eventually led to The Timken Roller Bearing Company. The M.I.T. engineers came to our Canton, Ohio, plant, were impressed with our gage facilities and our gage laboratory—acknowledged as one of the U. S. industry's finest—and asked if we would help them out.

Ordinarily we do not make gages for anyone's use other than our own, but because this was an important National Defense project, we agreed to make them. And we did.

To make the finest roller bearings we need the most accurate gages. Our fine gage laboratory is one of the reasons that Timken tapered roller bearings are considered to be the world's best.

So if you're looking for accuracy in the machines you build or buy, look to Timken tapered roller bearings. They practically eliminate friction, take any combination of radial and thrust loads, insure lasting precision. The Timken Roller Bearing Company, Canton 6, Ohio, U.S.A.
CANADIAN PLANT: St. Thomas, Ontario. Cable: "TIMROSCO".

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FOR CANADIAN INDUSTRY

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